UNIVERSITY OF CALIFORNIA
DIVISION OF AGRICULTURE AND NATURAL RESOURCES

2013 Combined Research and Extension Federal Annual Report

Agricultural Experiment Station
and Cooperative Extension

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Approved

University of California
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2013 University of California Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

Executive Summary

The University of California Division of Agriculture and Natural Resources (UC ANR) is the major land grant arm for the university and the state, as part of the nationwide public university system "built on behalf of the people" (Abraham Lincoln). The Agricultural Experiment Station (AES) was established to develop cutting-edge research information that can be applied to solving real-world problems in agriculture and natural resources. Cooperative Extension (CE) was created as a cadre of academics housed in local communities to translate and test research findings for practical, local solutions. UC ANR is unique in its three way partnership with federal, state and county governments to provide these local and statewide research and extension programs that address the critical issues of California. Through its partnerships and collaborations, UC ANR is able to leverage its resources to increase its ability to address these issues.

UC, ANR's mission is to:

- Maintain and enhance connections that fully engage UC with the people of California
- Achieve innovation in fundamental and applied research and education that supports
    - sustainable, safe, nutritious food production and delivery systems
    - economic success in a global economy
    - a sustainable, healthy, productive environment
    - science literacy and youth development programs

Agricultural Experiment Station faculty members conduct research and teach in three colleges and one professional school on the Davis, Berkeley and Riverside campuses. The AES has over 650 academic researchers, most of whom also have professorial appointments representing dozens of scientific disciplines. Cooperative Extension, the principal outreach arm of the Division, comprises academic appointees attached to campus departments as CE specialists or local offices as CE advisors. There are around 115 specialists and 170 advisors conducting outreach, education, as well as research across California's 58 counties. Nine research and extension centers (RECs), located in a variety of ecosystems across the state, provide a core research and extension base. Six statewide programs focus on specific issues that engage UC ANR academics and UC faculty from all the other campuses, allowing integrated teams to work on complex issues that need multidisciplinary approaches.

FY 2013

The Division's priority remains to hire new academics to vigorously rebuild Cooperative Extension given the many retirements over the past few years. In order to continue to fulfill the mission to provide science-based solutions and boots on the ground throughout California, it is imperative that ANR invest in academic positions. Nineteen CE advisor and specialist positions were released for recruitment and hiring in three rounds during FY 2013. Three of the 19 approved positions moved forward with the support of newly forming partnerships with the California Table Grape Commission, the California Pistachio Research Board, and the California Rice Research Board.

UC ANR continued to be faced with ongoing budget constraints, and seeks alternative ways to support programs. Several years ago the Division began to develop the Cooperative Extension multi-county partnership model which aims to save multiple participating counties and the University funds while maintaining the strength of local programs. It is used, where appropriate, instead of the historic individual county-based administrative units. Significant input from internal and external stakeholders continues to guide this strategy to increase administrative efficiency. In particular, the County Directors Council participates in the ongoing evaluations and discussions with internal task forces formed to analyze the potential for multi-county partnerships around the state. There are now two established multi-county partnerships, with the one (Fresno/Madera) added during FY 2013. A couple others have also been under development during FY 2013.

FY 2013 was an exciting year for the Division, with two large efforts to strengthen the UC ANR network through breaking ground on a new ANR building and a Statewide Conference. The new building consolidated 160 people across 18 different UC ANR in an effort to create greater efficiencies and enhance collaboration and communication. Construction began in April 2013 and move was completed in November.

For the first time since 2009, UC ANR held an all-staff statewide conference in April 2013. It brought together more than 600 academics and staff across the Division to make new contacts, renew networks, and find challenging new ideas to bring home. The conference included a one day, high-profile forum, two days of diverse professional development sessions, and pre-conference tours designed to demonstrate the breadth and depth of UC ANR's work in Southern California where the conference was held. The first day Global Food System Forum was an important and exciting opportunity for renowned researchers, policy makers, producers, and other food system leaders to address pressing issues and discuss potential solutions for feeding the world's population using a healthy and ecologically sustainable food supply. The keynote address was given by Mary Robinson, former President of Ireland and President of the Mary Robinson Foundation - Climate Justice. The first panel focused on the geopolitical, ethical, economic and technical challenges facing food systems from a global perspective, and the second panel built on the prior discussions from a California perspective. 1,500 individuals from 34 different countries and six continents watched the forum live. Nearly 300 people joined the associated online conversation on Twitter, spurring the forum hashtag #Food2025 to trend as the third most popular Twitter topic during the event.

UC ANR continues to make significant progress toward its Strategic Vision 2025. The Vision identifies multidisciplinary, integrated Strategic Initiatives that represent the best opportunities for UC ANR's considerable infrastructure and talent to seek new resources and new ways of partnering within and outside the University to find solutions to the issues that will

be facing California in 2025. During 2013 UC ANR continued work on the following five initiatives: 1) Healthy Families and Communities; 2) Sustainable Natural Ecosystems; 3) Endemic and Invasive Pests and Diseases; 4) Sustainable Food Systems; and 5) Water Quality, Quantity, and Quality.

During 2013 UC ANR launched a third round of the internal competitive grants program. The purpose is to strategically address issues identified by at one least one of the Strategic Initiatives. Given the complexity of the issues that need to be addressed, UC ANR highly encourages cross-initiative proposals and collaboration among academics. The program invests in short-term, high-impact projects that strengthen the research-extension network and contribute policy-relevant outcomes that address significant agricultural, economic, environmental and social issues in California. This cycle, Principal investigators were able to submit proposals for research and/or extension projects. Early-career academics were strongly encouraged to apply. The five strategic initiative panels reviewed 195 letters of intent for strong, substantive connections to initiative priorities, and invited authors of 70 letters of intent to submit full proposals. 65 full proposals were received. Proposals are evaluated on technical merit, relevance to California and likelihood of impact, feasibility of achieving objectives in the specified time frame, and clear indications that the proposed work aimed to develop and/or enhance meaningful partnerships and collaborations among ANR and with external stakeholders.

For FY2013, UC ANR will no longer report on Climate Change as a separate federal Planned Program since this is no longer required by NIFA, and the Division approaches this important area a cross cutting issue. Thus the research and extension climate change work is reported in several, different Federal Planned programs.

For FY 2013, California reports on the following six Federal Planned Programs:

1. Healthy Families and Communities
2. Sustainable Food Systems
3. Endemic and Invasive Pests
4. Sustainable Natural Ecosystems
5. Water Quality, Quantity, and Security
6. Sustainable Energy

The following narratives describe the FY 2013 program highlights for these Federal Planned Programs.

Healthy Families and Communities

Childhood obesity and positive youth development, including increasing youth science literacy, are key issues being addressed through Healthy Families and Communities' research and outreach programs. Seventy seven Hatch and Multistate Research projects were conducted by investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 24 research and extension projects. CE advisors worked on 273 extension projects, and led an additional 18 research projects under the Federal Planned Program Healthy Families and Communities. The following discussion illustrates some of the significant work that was conducted by UC ANR in 2013:

Childhood Obesity

Causes, prevention, and intervention of obesity issues are being examined. Breast feeding is linked to childhood obesity prevention, yet women often have issues with breast feeding. Bottle feeding decreases control of milk/formula intake, which may be linked to weight issues. An improved nipple design was found to facilitate better infant control over milk/formula. Several studies are investigating the genetic pathways of developing obesity and chronic diseases. The connection between bacteria, health and diseases is also being better understood which will impact long-term strategies employed to improve human health, specially improving conditions of children and adults living with chronic disease. Behavioral characteristics contributing to childhood obesity and strategies to reduce risk of type 2 diabetes include the reduction of sugar sweetened beverages, increasing fruit and vegetables, and assisting partners in evaluation of outcomes. For example, the USDA Fresh Fruit and Vegetable Program provided evidence of having a positive impact on children's nutritional health. Factors related to obesity in Mexican American families relative to their Mexican counterparts (less physical activity, less time to prepare food, poor food quality, and greater availability of fast food) have been identified. The effectiveness of a Fresno county nutrition-fitness summer camp targeting low-income youth showed a significant decrease in abdominal fat measured by waist circumference. Early findings suggest that a nutrition-fitness summer camp resulted in greater outcomes among children compared to those in a general summer camp including an increase in healthy food choice in participating children's families, increased physical activity, and weight loss.

Human Nutrition and Health

Studies on health and diseases, and diet and nutrition at levels of analyses spanned from the cellular to behavioral levels. Fruits, vegetables, and soy products protective abilities to promote health through metabolism are being examined. In one project, compounds in the cabbage family that appear to be beneficial against diseases such as cancer, viral and bacterial infections, and immune deficiency diseases has been examined. The link between vitamins and obesity, including how activating vitamin A into retinoic acid controls the development of fat tissue and how vitamin C may aid in the treatment of obesity are being better understood. Research is being conducted on the molecular mechanisms of dietary restriction's protection against aging and the diseases of aging. Additional behavioral studies ranged from consumer food choices due to one's sensory influences to addressing dietary restrictions. For example, older adults effectively used food labels well when they had a specific health goal (e.g., sodium restriction). Factors that influence adolescents' consumption of calcium rich foods have been identified; message boards targeting parents of youth at higher risk for developing osteoporosis including Hispanics, Asians, and Caucasians have been created. California consumer changes and trends research revealed a variety of healthier food products and development of methods for agriculture and producers to respond to trends. An international study revealed social media assisted consumers in identifying and purchasing safer, healthier, and greener products.

Nutrition Education

According to the California Health Interview Survey (2009; 2011) the percent of overweight/obese economically disadvantaged adults rose from 59.6% to 65.4%. Nearly one-third of California's school children are classified as overweight/obese (Madsen, 2010). Families in need of nutrition education outnumber available programs in California, as

there were 1,111,400 families below the poverty level within the past 12 months (2012 American Community Survey). Educators from two unique programs, the Expanded Food and Nutrition Education Program (EFNEP) and the Supplemental Nutrition Assistance Program-Education Connection (SNAP-Ed; CalFresh in California), provided nutrition education to 183,747 low-income families, adults, and youth. Improved skills and behaviors in food budgeting practices, decreasing fat, sugar, and salt in foods, increasing physical activity, and consumption of healthier foods such as whole grains, fruits, and vegetables were demonstrated. Extension staff piloted techniques to reach a greater number of the low-income population through non-traditional education methods. Fifteen volunteers were trained to deliver nutrition and food management lessons to more than 1,200 parents in San Joaquin county resulting in a greater intake of fruits and vegetables and increased parental confidence in helping their children lead healthy lifestyles. More than 250 multi-ethnic income elders in six sites across Alameda county received seven hours of nutrition education learning healthy eating habits and staying more active through an interactive technology. In other projects, nutrition specialists conducted training for nutrition educators on nutrition education curricula and produced a parent newsletter to promote healthy nutrition for their children. Use of the newsletter resulted in lowered body mass index in children.

Youth Development

Youth development research included science literacy and positive youth development. Findings from agriculture and environmental literacy in formal and non-formal education systems will be used to design more effective science literacy education strategies. One important finding for both channels of educating youth is that agriculture science and technology are not well understood by urban youth. Emotional, social, and interactions within the youths' environments are being examined on positive and negative youth development influences. Adolescent social phobia has been studied and linked to vulnerability to cognitive-affective disorders; results presented have alerted teachers to potential behavior in some youth. Exposure to ethnic diversity in schools is being evaluated for cross-ethnic friendships in adolescents and potential predictions to social adjustment in emerging adulthood. In the "Youth Voices for Change" study, researchers are studying how the physical environment contributes to healthy adolescent development; and how engaging youth in the process aids in understanding and creating supportive physical environments. This on-going study has resulted in regional youth forums, symposia, and manuscripts; has continued to influence design of parks and youth spaces; and has contributed to regional policy and planning. Finally, early findings from the evaluation of the 4-H Thrive curriculum included that 4-H youth had more positive outcomes than youth not involved in 4-H, and that 4-H youth who participated in the 4-H Thrive curriculum increased their special interests, mindset, and goal management skills.

The UC 4-H Youth Development Program (4-H YDP) had 79,629 youth participants including 34,810 in traditional clubs; 3,404 on 4-H military installations; 30,801in school enrichment programs; and 5,690 in 4-H camping programs (some youth participated in 4-H through more than one modality.) Youth selected Healthy Living projects 9,387 times that promoted holistic health ranging from nutrition/healthy foods, physical activities, cooking, gardening, and general safety. Science, Engineering, and Technology projects were selected 99,787 times, which encourages interest in science and increase scientific literacy. One youth club built and installed solar panels from scratch to enable low-cost interior and exterior lighting. Citizenship and Leadership projects were chosen 20,796 times, which enhanced their civic engagement, community, leadership, and expressive arts skills by. Youth served as club officers to plan the club's scope of work and direct community service activities. Youth

developed or improved community gardens to provide produce to schools, communities, and local food banks. They assembled and distributed 250 first aid kits to 4-H clubs, local high schools, and other community programs. Talents were also showcased in projects including theatre productions plays, concerts, creating cultural masks, and designing and sewing clothing. 4-H volunteers trained 575 additional volunteers to deliver curriculum lessons to 2,800 youth in 35 counties. The curriculum (Thrive) was designed to promote positive youth development through developing youths': goal management skills, ability to identify and nurture specific interests which motivate them, ability to reflect on their progress, and develop an understanding that hard work, not inherit ability drives success. More than 500 youth documented their experiences in health, science, and citizenship, and Thriving through CA 4-H YDP's innovative Online Record Book system.

Evaluating needs for all California youth is a huge task. A forum was conducted to identify strategies to increase enrollment of culturally diverse youth in the 4-H Youth Development Program, as this was a recognized need. The UC Davis Center for Regional Change and UCCE collaborated to generate an interactive website with a Youth Well-being Index (which identifies where youth are thriving based on physical and emotional health, educational outcomes, social relationships and community contexts) and a Youth Vulnerability Index (which identifies where youth are vulnerable based on school drop-out/push-out, foster care referrals, teen pregnancy, and low-household incomes). The maps are a useful utility for community assessment; grant proposal; public and private investment; public policy and community support at local, regional, and statewide levels; and the ability to track results over time.

Sustainable Food Systems

Projected population growth, widespread poverty, acute water issues, and declining agricultural productivity within the context of climate change create an urgency to increase food production in ways that are more efficient and sustainable. Food security is both a national and global issue.

California agriculture plays a vital role in providing an abundant source of safe, nutritious, and remarkably inexpensive food for its residents, the nation, and the world. California has been an innovative leader in food production for more than a century. California is a major producer of vegetables, fruits, nuts (nearly 50% of the nation's supply), and dairy products (more than 20% of the nation's supply). These are healthy and under-consumed sources of nutrition for Californians and people nationwide. More than 400 commodities are produced in the state. California agriculture faces unprecedented challenges to its sustainability, including climate change, water constraints (quantity and quality), regulation, labor, invasive species, urbanization, and other factors. Much of the impact of California agriculture upon the nation and the world has been due to the University of California's research and Extension efforts, which demonstrate breadth and depth of expertise and innovation.

In addition, UC ANR is leveraging significant resources around the areas of urban agriculture and local/regional food systems. This research and Extension work includes production information, additional economic studies, small producer/beginning farmer training, food safety training for small-scale producers, the development of an urban agriculture portal, edible landscape guides, volunteer training, farm-to-school work (with schools, with districts and with producers seeking to access this model), and work in public policy on food councils.

Two hundred and twenty nine Hatch and Multistate Research projects were conducted by investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 64 research and extension projects. CE advisors worked on 455 extension projects, and led an additional 87 research projects under the Federal Planned Program: Sustainable Food Systems. The following projects illustrate the types and range of projects with important results being conducted by academic and non-academic personnel located in county extension offices, the three UC ANR campuses, several Research and Extension Centers, and occasionally on USDA facilities in collaborative efforts:

Food Access and Diversity in the Food System

- More than 200,000 homes in California subscribe to community supported agriculture (CSA) programs. Research on expanding CSA sales and access in California is having positive impacts on producers, consumers and public policy. Producers are gaining better information about the characteristics of their customers, adopting successful strategies to reach new customers, and learning how to improve
- the economics of this model. A focus is on helping CSA producers expand their membership to include historically under-represented groups, including residents engaged with the USDA's food entitlement programs; an expected outcome is increased food security and food access, as well as improved nutrition for at-risk populations.
- A project focusing on the history and viability of immigrant farmers of Southeast Asian descent in the Central Valley is exploring vital issues, including farm-level practices, land access, labor, capital, and social capital resident in Hmong and Mien producers to address agriculture and food policy issues in the State. Many of these farmers are beginning farmers; some of the strategies identified in this research may help them access new, smaller-scale opportunities, such as farm-to-school and organic production.
- A new Farmers Individual Development Account program developed by UC in collaboration with community partners helped beginning producers save money for future investment in capital improvement for their farms.
- A project on Science and the New Constitution of Health and Environment is analyzing the role and authority of scientific experts in shaping the outcomes of international legal disputes involving health and environment and in allocating power across the global, federal, state and local levels.

Specialty Crops

- An ongoing strawberry breeding project has resulted in twenty strawberry cultivars in the last 22 years. These advances in breeding have made strawberries a year-round crop with high quality and reasonable prices. Strawberries represent approximately $2.3B in revenue for California producers.
- Alternative weed control options for California strawberry and vegetable growers is helping producers cope with the loss of herbicides (through regulatory action), as well as labor shortages and increasing energy costs. These integrated weed management strategies may allow reduced pesticide inputs and ease regulatory concerns, as well as hold down production costs for this $5B sector.
- A molecular genetic improvement project focusing on California's specialty crops has demonstrated a novel strategy to modify chloroplast development in tomato fruit and to significantly improve fruit quality.
- A series of projects on precision technologies for specialty crop production - some using wireless sensor networks - has had positive economic and environmental impacts, through

reduced water usage, and more precise application of inputs to enhance crop yields. In one trial at two container nurseries, water use was reduced by 35% with automated irrigation.

Food Safety

- Applied studies are proving to be of direct relevance to successful pre- and post-processing handling of products by the fresh-cut industry.
- The Better Process Control School, a program authorized by the FDA, covers the principles of low-acid canning. Approximately 300 individuals were trained in the U.S. Fresh-Cut Products Workshop, a 3-day course offered by instructors from the UC Postharvest Technology Research and Information Center. A two-week course for industry professionals was also offered.
- The almond industry is using UC research on the control of food-borne pathogens in pre- and post-harvest environments to revise guidance documents for validation studies for thermal processes applied to almonds.

Plant Production and Genetics

- Development of new cultivars can provide producers with additional market opportunities and consumers with better tasting, more attractive, low-seed fruits and vegetables. More than 3M trees of a mandarin cultivar (Tango, 2006) were sold by 2012, making it one of the most successful citrus cultivars released in the U.S. Asparagus cultivar "DePaoli" (2006) has been planted in significant acreage in California, and is being tested in other countries.
- The U.S. is the world's largest pistachio producer; California produces 95% of the U.S. total crop. New pistachio cultivars developed by UC have proven to be very successful. They provide improved marketable yield, an early harvest option, and the potential of reduced navel orange worm infestation. The "Golden Hills" cultivar is being planted on more than 7,000 acres.
- New cut-flower breeding methods for Gerbera hybrid, designed to improve performance, have resulted in genotypes which are available for further testing under commercial conditions.
- The potential benefits of conservation tillage and residue management are being explored in several projects. It has been shown in repeated trials that no-tillage plus high-residue preservation practices reduce soil water evaporation in summer. In trials with cotton, conservation tillage has also shown that fuel reduction up to 70% and a soil carbon increase of 20% were achieved. Dust emissions were reduced by more than 60%, relative to conventional till approaches. The total cultural cost of tomato production was reduced as well. UC's Conservation Tillage (CT) workgroup now numbers more than 1,000 researchers, extension educators, farmers, USDA NRCS and private sector partners.
- Pollination is of vital importance to agricultural productivity. UC researchers are determining the potential of native bees as pollinators for almonds and other crops, and have developed lists of plant species that support native pollinators. Farmers, gardeners and school groups are putting into practice bee friendly habitat using guidelines provided.
- Seeds represent the primary food source for the majority of human populations. Seed formation is also critical to the formation of most fruits. UC's work in genetic and molecular analysis of ovule development provides new information on the critical process of ovule development and the regulation of plant development. This understanding translates into novel methods for engineered regulation of gene expression for crop improvement or biomedical applications.

Plant Protection

- One project focused on enhancing biodiversity in agro ecosystems to improve pest regulation and sustainable production provides a scientific evaluation of on-farm habitat management strategies to develop cost-effective biological control options of important arthropod pests of California vineyards. Many farmers adopting the various Floral Resource Provisioning (FPR) designs have reported that they have been able to reduce the application of insecticides or organic products for pest control. Some farmers reported that the use of certain flower mixtures have brought additional benefits, including weed suppression, improved soil quality, and improved water storage. The training of farm workers on insect identification and monitoring has proven useful.
- Protecting plants means protecting pollinators. One study focused on assessing and enhancing the contributions of native bees to agricultural pollination. Based on data gathered, algorithms have been developed for selecting diverse plant materials. Trials of alternative planting methods have enabled transfer of knowledge to others.

Animals and Their Systems

- A series of applied animal behavior and welfare projects develop animal behavior measurement techniques to assess on-farm welfare challenges and evaluate alternative management strategies, with a focus on improving animal welfare and reducing losses in poultry production.
- One poultry project improves energy and resource use efficiency through light management. Results showed that dimmer lighting might confer some welfare and production benefits in commercial settings.
- A project focusing on management systems to improve the economic and environmental sustainability of dairy enterprises could help the state's large dairy industry.
- Air quality remains a vitally important concern in California. Understanding the range of emissions from dairies and poultry operations is a major prerequisite for designing emission mitigation strategies. UC is gathering scientific measurement data and developing process-based emission models that will allow the analysis of factors that affect emissions under different farm management practices and environmental conditions.

Technological Innovation

- UC is making data from UC ANR's Research and Extension Center (REC) system broadly available via web-based applications through its IGIS program, in order to increase the ability to make meaningful predictions of the agricultural and ecosystem response to future change, and to increase our understanding of opportunities to enhance agricultural production. Sensing instrumentation was placed at several RECs.
- A research project is focusing on developing feasible mechanical harvesting of California black ripe table olives. Two major impacts occurred. There are now approximately 800 acres planted using the methods suggested by earlier research. A 40-acre trial demonstrated trunk shaking could harvest properly prepared Manzanillo olives more efficiently and as economically as hand pickers.
- A soilless plant growing systems research project resulted in findings that are particularly relevant to hydroponic lettuce production.
- Research on precision irrigation, fertilization, and management of specialty crops by wireless sensor networks features wireless nodes and actuation hardware/software. Precision agriculture leads to economic and environmental benefits since it involves applying inputs

such as chemicals and water on a site-specific basis to enhance crop yield, reduce inputs, and/or reduce environmental damage.

- Research demonstrated the feasibility of using an x-ray transmission sensor to automatically detect the location of transplanted row crops in the field during cultivation. Results show that the sensor was accurate and could be used to automatically control the operation of mechanical weed knives, potentially providing farmers with an alternative to manual or chemical methods of weed control within the crop row. Researchers also worked on a project to develop mechanical harvesting for California black ripe processed olives.

Economics, Markets, and Policy

- The focus of an agricultural sustainability and food labeling policy project is to develop an understanding of what types of sustainability-related labeling standards are workable and which will improve consumer welfare, producer welfare, or sustainability of production. The research has gained traction through publications, and enabled the investigation of private benefits and the social costs of various forms of producer cooperation.
- A modeling workhorse to address agro-environmental problems arising from cropping systems was also produced; this study provides important insight into the likely effects of nitrogen taxes, a policy currently under consideration in California to mitigate nitrate pollution in water.
- An analysis of new challenges and opportunities for California's mandated marketing programs analyzed the effectiveness of various messages and specific promotional material. Results enabled producers and industry groups to fine-tune messages. Knowledge regarding the success of these programs contributed to them being renewed by vote of the producers operating under the programs.
- While agricultural index insurance contracts promise a cost-effective way to remove risk from a variety of farming and livestock systems, uptake of these contracts has often been tepid and their beneficial economic impacts consequently muted. This international research focuses on more intelligently design index insurance contacts. Three sets of findings emerged during this phase of study, and have been publicly cited by the administrator of USAID.
- An ongoing research project has outcomes that explain how immigration and other policy changes are affecting the U.S. farm labor market. The research is of great use to policy makers developing immigration reform proposals.
- UC's work in agritourism is enabling small and mid-scale producers to diversify their operations. Producers were trained in agritourism challenges and opportunities, business planning, risk management, hospitality and effective marketing. The work also facilitated the development of new regional networks, and engagement with local planning and community development agencies to reduce permitting and regulatory barriers.
- California agro ecosystem assessment project continues to engage external stakeholders and policy makers.

Endemic and Invasive Pests and Diseases

Pests and disease affect the viability and productivity of agriculture, natural resources, public health and the environment of Californians. The speed and frequency of international travel today, combined with the volume of imported food, commodities and materials have greatly increased the rate of establishment of invasive pests and diseases in California. As global climate patterns shift, the distribution of pests and diseases will change, and many

habitats will become more susceptible to new threats. The Endemic and Invasive Pests and Diseases Initiative goals are to foster research and extension programs that1) exclude pests and diseases through improved detection and diagnostics,2) develop information that responds to emerging problems with pests and disease,and3) provide long-term integrated pest management (IPM) solutions for established pests.

One hundred and sixty one Hatch and Multistate Research projects were conducted by investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 62 research and extension projects. CE advisors worked on 304 extension projects, and led an additional 77 research projects under the Federal Planned Program Endemic and Invasive Pests and Diseases. The following discussion illustrates some of the2013 research highlights within each of these EIPD initiative goals:

Exclusion of pests and diseases through early detection and diagnostics.

The first step in controlling the damage of any pest or disease, be it arthropods, vertebrates, weeds, or pathogens, is to exclude it from entering a new region. Exclusion includes diagnostics, detection and interception. Eradication of pests and diseases maybe feasible if an early detection system is in place. Lack of early detection may result in expensive pest and disease management costs in the long-term, disruption in commerce and industry prosperity, and human and animal health impacts if diseases are involved. The following are examples of UC ANR projects addressing problems in the areas of detection of invasive pests and diseases.

- Genetic methods are being used to study the origins and biology of invasive (exotic) insects impacting California cropping systems, such as tephritid fruit flies (e.g., olive fly), glassy-winged sharpshooter, Bemisia whiteflies, and vine mealybug. An invasive species database is being developed.
- Soil-dwelling nematodes affect the growth and health of plants and can be parasites of vertebrates. Research teams have isolated nematodes from soil, established invitrocultures, conducted light microscopy, photographic image acquisition and analysis,nematode morphometrics, nucleicacidextraction, PCR primer design, polymerase chain reaction amplification, DNA sequencing, multiple sequence alignment, and phylogenetic analyses. These gene sequences are of value to ecologists, nematologists, soil scientists and regulators because they area type of "DNA barcode" for nematode identification, revealing new species and providing methods to enhance breeding of crops for nematode resistance.
- The identification of the pheromone of an armored scale Acutaspis albopicta was completed. This scale is likely to enter California on imported Mexican avocados and could be quite damaging to California crops including avocados and citrus. Pheromone traps are currently being deployed by the USDA and the avocado industry near several packinghouses which handle imported fruit in the hope of catching an incipient infestation early enough so that eradication might be attempted. A study of the development of this scale showed that males require high humidity to complete their final molt, suggesting that if they do become established in California, they may be limited to the humid avocado production areas.
- Identification, syntheses, and development of applications for the pheromones of vine, longtailed, grape, and obscure mealybugs is now paying off. The pheromones of all four of these species are now commercially available and finding increasing use in agriculture, both in the US and abroad. Sensitive tools for detection and monitoring of

these species have become important because of the recent increase in the incidence of leafroll viruses that ruin grape and wine quality, and can kill vines.

- Grapevine leafroll-associated viruses are a problem for grape production globally. Symptoms are caused by a number of distinct viral species. During a survey of Napa Valley vineyards (California, USA), researchers found evidence of a new variant of Grapevine leafroll-associated virus 3 (GLRaV-3). Its genome has been fully sequenced and it groups most closely with a recently sequenced variant from South Africa and a partial sequence from New Zealand. This divergent GLRaV-3 phylogroup is already present in grape-growing regions worldwide.

Emerging problems with pests and diseases

When new pests and/or diseases emerge, they need to be addressed in order to protect animal health, plant health, public health, food security, food safety, and the environment. Often newly arrived pests and diseases are problems because they lack natural control agents, creating devastating problems as they spread. Endemic pests and diseases can also develop into more serious problems because of external factors such as changes in climate and plant/animal management practices. The following are examples of UC ANR projects addressing problems in the areas of emerging problems with pests and diseases:

- The bacterium Xylella fastidiosa, that causes Pierce's Disease in grapes continues to be a focus of study by a number of research teams. Strategies aimed at disrupting the interaction between the host plant, vector, and bacterium will lead to reductions in disease spread. Research programs focusing on the pathogen target the ability of Xf to acquire essential nutrients, to adhere to the host cell surfaces, and to escape any host defense mechanisms. Studies targeting the vector demonstrate that regular or even intermittent imidacloprid pesticide applications result in lower disease prevalence compared to untreated vineyards. Differences in insecticide treatments in vineyards do not appear to affect the abundance of natural enemies. Research to develop grape varieties with resistance to Xf continues.
- Honey bees are agriculture's major managed pollinator. They are responsible for pollinating crops worth billions of dollars each year. In California, honey bees are vital for almond production, a multibillion dollar sector of California's economy, along with several other fruits and vegetables. Recently, honey bees have been under great stress from viruses, mites, pesticides, subpar supplemental feeds, and interactions between these factors. These pressures in the popular press have fallen under the umbrella of Colony Collapse Disorder (CCD), but it is unclear to what extent the current die-offs in bees are due to one new syndrome or to a combination of separate stressors that just happen to have hit at once. Research on corn syrup feeds showed that these feeds are safe, and can potentially be more productive than sucrose feeds. As corn syrup is less expensive than sucrose, this is a beneficial result for commercial beekeepers. Work on viruses sheds light on how the management practices centered on almond pollination could be leading to increases in the exposure of bee to pathogens.
- Mosquito borne pathogens such as West Nile, Dengue and Chikungunya viruses have seen a dramatic increase and geographical expansion in the past five years. State -of the art molecular markers were used to determine that the Culex mosquito complex has sub-groups. This explains why mosquito abatement personnel face significant challenges controlling these mosquitoes because the complex is made up of several discreet populations that differ behaviorally and require different control strategies. Other studies of mosquitoes with regard to Dengue demonstrated 1) at a

given point in time, people and mosquitoes from a small portion of houses were responsible for the majority of transmission. Virus transmission risk was highest near infected children. 2) A series of studies were carried out on the impact of fluctuating daily temperatures on mosquito life history traits and capacity to transmit virus. Large temperature fluctuations contribute to seasonal reduction in virus transmission. This complexity is important to account for in virus transmission modeling, mosquito surveillance and disease prevention.

- Brown rot blossom blight and fruit rot, caused by Monilinia species, is a severe disease of peach and other stone fruits. Identification of genetic markers for brown rot resistance are being used to facilitate the rapid selection of promising genotypes in the breeding program and monitor for the presence of those markers as genotypes progress through the breeding program.
- Significant progress was made in relation to bagrada bug temperature requirements, seasonal migration and population dynamics, and host utilization. Studies have shown that warm temperatures are beneficial to these stink bugs as long as food and moisture are available. These findings suggest a narrow window of opportunity for a warm season insect to utilize cool season crops. Climate matching studies suggest that bagrada bug will continue to expand its range where brassicaceous plants are grown and the winter temperature is not severe enough to kill overwintering populations.

Integrated Management

When pests and/or pathogens become established in California, integrated management tactics(biological, chemical, cultural, plant resistance) are needed to reduce their impact on agriculture, natural resources, communities, and human health. The following are examples of UC ANR projects addressing integrated management of pests and diseases:

- Biological control is a cornerstone of managing both invasive and endemic pests of agricultural crops. Surveys for natural enemies were conducted for the light brown applied moth, citrus leafminer, whiteflies and aphids. Biological control agents were imported and host range testing was conducted on parasitoid wasps of the light brown apple moth, mealybugs and Asian citrus psyllid. The effects of weather and climate change on the distribution and abundance of agricultural pests and the efficacy of their natural enemies was evaluated by embedding physiologically based weather-driven models into geographic information systems. The origins and demographic history of insect populations can be used as a guide to find natural enemies for biological control as well as to understand the invasion biology of pests, their natural enemies, and symbionts, in their native and invaded habitats.
- Echinochloa phyllopogon is an exotic weed of California rice paddies that has evolved resistance to multiple herbicides. Elimination of seedlings through certain weed control methods can limit the spread of this weed, but is contingent on accurate predictions of germination and emergence timing, which are influenced by seed dormancy levels. Successful control of herbicide-resistant E. phyllopogon now hinges on maximizing weed seedling recruitment in order to eliminate such seedlings prior to planting the crop. Thus, the stale seedbed approach entails recruiting and treating weeds prior to planting rice with a mechanical method or a broad-spectrum herbicide for which resistance does not exist in these weeds. Research suggests that E. phyllopogon dormancy release to enhance weed seed germination would benefit from field soil saturation for 3-4 weeks in winter, which will decrease time to seedling emergence, allowing for early-season weed control and a shortened crop planting delay.

- Studies of the etiology, epidemiology, biology, and management of fungal and bacterial diseases that are of importance in fruit crop production systems and we develop the most effective, economical, and safe management practices. For fruit crops, a focus of research has been the simultaneous development of pre- and postharvest treatments, as well as improved methods of using these treatments effectively through pathogen detection, environmental monitoring, predictive models, and new application technology. New treatments against fungal and bacterial diseases are being continuously developed to ensure that treatments for effective disease control are available for growers and packers of fresh fruit in a constantly changing environment that includes new disease outbreaks, development of resistance in pathogen populations, and changing regulatory requirements.
- Research revealed differences in the abundance and distribution of glyphosate resistance in Conyza canadensis and C. bonariensis across the Central Valley of California. Frequencies of resistant individuals in 42 sampled C. canadensis populations were higher in southern than northern regions and positively correlated with the size of ground water protection areas (GWPA) within counties. Population genetic analyses revealed multiple independent origins of resistance and indicated that resistant genotypes are likely to have undergone range expansion after glyphosate use began in agriculture but many years before it was detected. Thus, diversity in weed control practices prior to herbicide regulation in GWPA probably kept resistance frequencies low.
- The reduced use of agrochemicals and the increased use of organic control materials can be advanced through the integration of pest detection and treatment systems for high value fruit, nut and vegetable crops. Particularly in weed control, sensing the presence and location of target weeds within a crop area allows the treatment of the weed to be spatially localized on a leaf by leaf scale. In fungicide and insecticide applications, detection and treatment of target areas while avoiding unnecessary deposition on non-target areas is desirable, both economically and environmentally. New developments were created to address excessive use of chemicals. In particular, economic analyses were developed to address the cost and return of new designs for pesticide application.

Sustainable Natural Ecosystems

The term "Natural Ecosystems" refers collectively to forests, rangelands, and wetlands. In California, these lands are typically upstream or downstream of intensively managed agricultural and residential lands. They provide valuable goods and services to society but their ecological diversity and mixed ownership increase the complexity in regards to ensuring their sustainability. A central theme of the SNE program is to better understand the ecological and physical process that control overall system productivity and thereby better understand how these processes are managed in our highly variable climate. Even the ecosystems in federal parks and wilderness areas have significant interactions via fires, atmospheric-land deposition and emissions, with the private and public landscapes that are valued for the goods and services that are consumed or managed by California's residents. Population growth, climate change, land use change and fragmentation, and limited science literacy about these ecosystems are adding to the challenges. The goal of the ANR Sustainable Natural Ecosystems Strategic Initiative and Federal Planned Program is to have a large positive impact on California's natural resource ecosystems.

One hundred and thirty nine Hatch and Multistate research projects were conducted by investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 28 research and extension projects. CE advisors worked on 125 extension projects, and led an additional nine research projects under the Federal Planned Program Sustainable Natural Ecosystems. Projects are being conducted in several areas that are essential to sustaining California's natural resources. A few illustrative examples of the breadth of projects along with selected examples of high impact programs follow:

Range Resources Management

California's extensive grasslands are composed of mixes of annual grasses, perennial grasses, and well as various invasive or weed species. Streams, other water bodies, shrubs and scattered trees add to the complexity. In some sites, shrubs rather than grasses are the dominant plant. Interaction between introduced Mediterranean grasses, native grasses, and new waves of invasive weed species has existed for centuries. Two research projects use different approaches to explore the stability of different populations of exotic and native species as changing environmental conditions such as more extreme droughts, climate change, and changes in adjacent land use will stress the systems and the ecosystem services they provide. Another project on the microbial communities in the soil and how they control the nutrient cycling processes. These processes are often more important than simple area measurements in determining current and potential system productivities. Lastly, two other projects highlight the impact of nitrogen deposition that is closely tied to vehicle exhaust. Many of these projects will provide insights into how both grazing management and restoration efforts can be more effective as both social goals and environmental stressors change over time.

Aquatic and Terrestrial Wildlife Conservation

The viability of fish populations that bisect agricultural and urban areas as freshwater flows to the ocean is a key integrating factor across all natural ecosystems in California. Research was conducted and publications produced to develop a better understanding of the factors controlling the resilience and persistence of fish populations in both systems flowing through small streams into the San Francisco Bay as well as into larger rivers flowing into the California Bay-Delta. Terrestrial wildlife populations are also affected by both large natural events such as wildfires and vegetation management practices designed to reduce the negative impact of large wildfires as well as to provide products. Long term research was conducted on the population dynamics of mammals and of birds, which are crucial to understand the long term impacts on fish and wildlife of different management approaches.

Forest Resources Management

In the woodlands and forest areas that are typically upslope of the grasslands, research and publications defined how improving wildlife habitats can be integrated into the land management practices of private and public land managers. As we consider that impact that climate changes can have on shifting the optimal growing ranges for different species, a better understanding of the genetic makeup of different conifer species will be valuable in future forest planning and seedling replanting strategies. The crucial role of water use by overly dense forests due to decades of fire suppression and the remaining runoff into streams and rivers is also a focus of UC ANR research. Droughts, warming weather and changing precipitation patterns will affects forests, stream flows, as well as the fish populations and the diverted water that is moved around the state to support agriculture and urban areas.

Wildfire Management and Control

Another important issue for natural ecosystems on the residential fringe is addressing the seasonally high level of wildfire risk that can often be the single largest type of resource management expenditure in these areas. In addition to potentially altering soil erosion into high value water bodies such as Lake Tahoe, vegetation management to reduce fire risks can be expensive and have its own environmental impacts. A project focuses on better understanding the engineering factors that need to be considered to be design more effective machinery for vegetation management. Educating homeowners about fire-safe landscaping is one of the most effective ways to connect landowners with their quasi-natural surroundings, increase fire safety, reduce costs associated with property destruction, and reduce the risk of erosion and debris flows after a fire. Combined with the statewide efforts to educate homeowners through online tools to ensure that all homes are more resilient to any fire risks, these efforts can significantly reduce the costs and losses that result from the interaction of residences and seasonal wildfires.

Understanding and Valuing Ecosystem Services

Across all of these natural ecosystem-based activities, UC ANR professionals worked with the institutions that combine private and public interests, and have the goal of developing clearer linkages between the provision of ecosystem services and the necessary financial remuneration to continue effective resource management. The choices of cap and trade instruments and the potential use of offsets from terrestrial carbon sequestration in soil and plants is part of the focus of the project on market-based environmental regulation. A project on public policy in natural resource systems addresses issues such as the role of international trade, rent-seeking by special interest groups, and the level of efficiency of policy tools that involve both financial and natural resource institutions. Understanding how these systems work now as well as how they could work under different permutations of California's evolving climate policies will be critical if we are to effectively address new environmental challenges. Ecosystem services related to open space and natural habitats are highly valued by many residents of California. However, they can also be destroyed or put at risk by the pattern of new residential development. Economic growth and the competition for natural resources focuses on how best to do habitat conservation planning into new residential development planning as it affects land, fresh water, and recycled water allocations. A project focused on Western Riverside County will lay the foundation for more effective land conservation planning to ultimately lead to lower cost, higher quality conservation reserves.

Water Quality, Quantity, and Security

Water--essential to all life--can only be understood in the context of larger societal concerns such as food safety, climate change, land use, agricultural and ecosystem sustainability, global population growth, and urbanization. Reflecting its significance, water is an integral component of major governmental acts such as the federal Endangered Species Act, National Environmental Policy Act, Clean Water Act, and the state's Porter-Cologne Water Quality Control Act. In California, water is the life blood of the state's economy; its availability and quality is critical for the state's agricultural, urban, and environmental systems now and in perpetuity.

Several issues regarding California's water are paramount:

- The supply of water will be limited for all users.
- Competition for water will intensify among agricultural, urban, and environmental users, with water being transferred from agriculture to the latter two groups.
- Short- and long-term climate trends will exacerbate the problems associated with water availability.
- Degradation of water quality will become more important as a major public issue.
- Legal and regulatory decisions will have significant impacts on water use and quality among all sectors.

Twenty three Hatch and Multistate Research projects were awarded to investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 16 research and extension projects. CE advisors worked on 100 extension projects, and led an additional 6 research projects under the required Federal Planned Program Water Quality, Quantity, and Security. Projects are being performed in a number of areas that will directly impact California watersheds and California's water security. A few examples of these projects are provided below:

Aquaculture

Aquaculture continues to be important in the state. Aquaculture facilities may produce products for human consumption or for ecosystem restoration or maintenance (breeding and stocking). Research was performed to reduce water use and environmental impacts by converting from flow-through systems to recirculating systems. This requires filtration and other techniques to purify the wastewater before it is reintroduced into the system. The system built at UC Davis for this project has performed well and servesas a demonstration system for other aquaculture producers.

Groundwater Quantity and Quality

Management of groundwater recharge is important for both quantity and quality purposes. Increased in irrigation efficiency can lead to increased concentrations of salts being leached to groundwater aquifers. Modeling work was performed to assess the potential to increase groundwater recharge from storm events. This would increase the amount of freshwater recharge and reduce salinity concentrations. This work will be increasingly important as precipitation variability will increase with climate variability.

Water Use Efficiency

Increasing water use efficiency is critical to creating value from out water supplies. Work was performed on micro irrigation technologies to maximize potential water savings and crop yields. Management of the technologies is critical to reach these goals. Work on canopy cover sensing is being performed to help us determine orchard water use and water needs. The research to date has led to increased yields and thus increases in water use efficiency. Work is also being done to increase performance of soil moisture probes and leaf pressure chambers to refine our water management recommendations.

Ecosystem Conservation and Restoration

Stream restoration modeling work is being performed to help us improve stream ecosystems. Modeling of sediment transport is critical to increasing fisheries productivity. Sediment control is important to maintaining gravel beds that are important to fish egg development.

Water Quality and Nitrates

Nitrate pollution to groundwater sources is a major concern in California. Research to reduce nitrate pollution has focused on the main pathway, leaching. By increasing irrigation efficiency and optimizing nitrogen applications we can reduce leaching. Work on micro irrigation technologies has created several nutrient and irrigation relating applications that will reduce groundwater pollution and reduce leaching.

Informatics and GIS

We have been using informatics and Geographic Information Systems (GIS) to track groundwater quality, manage forests and water resources, monitor land use and growth and relate to water supply and water demand. This information can feed into policy debates concerning optimal growth and water management in California.

Water Policy

The importance of water to California and its economy is evidenced by the intensity of its policy debates. UC continues to inform these debates with sound science and with scientific policy analysis. We have developed the state's only comprehensive water management model that incorporates both economic and engineering parameters. This model is used to estimate the impacts of changes in water supply on the water sector. Research and outreach evaluated policy options to manage nitrate pollution in our groundwater systems. Additional work was done on the impacts of a change in water supply on the agricultural economy of the San Joaquin Valley.

Sustainable Energy

California has the most active biomass power plants of any state. Public policies that add the production of biomass feedstocks for power and fuel to the existing objectives of agricultural production systems have affected the work of many UC ANR scientists. Both purpose grown crops and crops residues are used or will be used for these purposes. Adding new demands on agricultural systems alters demands for agricultural products, and results in new public scrutiny about the efficiency and sustainability of biomass production systems. California also has large amounts of woody biomass from forests, and some high moisture biomass from its extensive food processing industry. Forestry residues currently are used for biopower production and this use could increase with favorable policies. Interest in biogas production from these residues and from dairy manure is increasing.

At UC Berkeley there is the Energy Biosciences Institute (EBI), which is part of a unique partnership with three other research partners, the Lawrence Berkeley National Laboratory, the University of Illinois at Urbana-Champaign, and British Petroleum (BP). It was created in 2007

by a 10-year $500 million grant from BP. More than 300 researchers, including AES faculty, study the complete bioenergy life cycle, beginning with the feedstocks, continuing through biomass depolymerization, and ending with finding a more effective fermentation process. At UC Davis there is the Bioenergy Research Center, which is a coalition of over one hundred campus research scientists from a wide range of disciplines, seeking to advance the development of bioenergy: heat, power, and biofuels from biomass as part of their work. Also at UC Davis is the California Biomass Collaborative which is part of the statewide California Renewable Energy Collaborative, and includes more than 500 members from government, industry, academia, and environmental organizations.

Twelve Hatch and Multistate Research projects with a sustainable energy focus were conducted by investigators at UC Davis, and Berkeley, and Riverside. There were also five projects conducted by CE advisors, CE specialists, and other UC ANR academics under the Federal Planned Program Sustainable Energy. Projects are being conducted in several areas that are essential to sustaining California's energy resources; a few illustrative examples follow:

Biofuel Crops

Biofuel crops must be produced as efficiently as possible in order to not compete with food crops on prime agricultural lands. Biofuels are needed in California to meet the state's requirements for low carbon intensity fuels under the Low Carbon Fuel Standard. Executive order S-0606 calls for in-state production of biofuels to add to the state's economy, as well as meet its new greenhouse gas reduction goals. UC research is conducted to evaluate potential biofuel feedstock crops for California, including sorghum, oilseed crops, sugarbeets, etc. A few examples from 2013 follow:

- One project investigates sorghum as a low-input crop for bioenergy, food and feed in California. Sorghum has considerable potential as both a short-term and long-term solution for California's need for a sustainable bioenergy feedstock. Sorghum can be used in all the various processes for bioenergy production - starch-to-ethanol, sugar-to-ethanol, and lignocellulose-to-bioenergy. Furthermore, sorghum is a C4 plant that is drought tolerant and uses less fertilizer inputs than other crops, but which can respond very well to both additional irrigation and fertilizer. Replicated field trials have been planted throughout the state in the attempt to answer question: can sorghum be used as a renewable, viable energy crop in California?
- Another project conducted a series of variety trials and agronomic studies across California to identify the best oilseed varieties, as well as agronomic practices, for different regions of the state. This work includes the economic evaluation of the oilseed crops in diverse farming or farming/ranching systems throughout the state. California currently has 12 companies producing biodiesel, which would benefit from additional supplies of locally-produced vegetable oils. The production of winter annual oilseed crops to meet this demand will also provide new crop options for growers.
- A project to develop microalgae conversion systems for enhanced biofuel and bioproduct refining was conducted. The wine industry is economically important to many counties throughout California. It is estimated that for every gallon of wine produced, there are six gallons of wastewater byproduct. A possible wastewater solution is to use algae to remove nutrients, which has the added benefit of producing biomass that can be used to make biofuels. Chlorella sorokiniana UTEX 2805 was grown on winery wastewater were shown to remove 100% of the nitrogen and phosphorous, and

contained a high percentage of starch from the dry mass indicating the biomass may have value for biofuel production.

Biofuel Production

Currently the most costly aspects of biofuel production are related to cell wall "recalcitrance" to disassembly. A few projects focus on addressing this issue:

- One project aims at finding efficient (i.e., less expensive) ways to break cell walls down. This research specifically aims to obtain the information needed to develop biochemical approaches for disassembling the cell walls of biofuel feedstock organisms.
- Research was also conducted to generate plants with "designer" wall structures representing novel biomaterials and feedstocks for biorefineries.
- Another project focused on the development of efficient plant-microbe systems for energy alternatives. The focus is to develop microbial-based bioconversion systems of different types of plant biomass, under different conditions.
- Another project worked to identify and characterize bacterial enzymes for the deconstruction of plant cell wall polymers.

Woody Biomass

Woody biomass is a broad, generic category that encompasses all woody materials that accumulate to problematic levels. This includes material from forest, agriculture, and urban environments. This woody material is recognized to be a potential feedstock to produce bioenergy either directly through thermochemical processes such as combustion or indirectly by producing intermediary fuels such as syngas, alcohol, or wood pellets that can be used to produce electricity in steam driven generators or as transportation fuels. A few examples of projects that explored woody biomass as a bioenergy opportunity follow:

- The Woody Biomass Utilization group was active providing input to the California Public Utilities Commission (CPUC) and the Energy Commission (CEC) on proceedings related to forest based bioenergy. The CPUC is developing an implementation plan for Senate Bill 1122 (SB 1122). UC ANR academics provided feedback on technical shortcomings of previous assessments of the resource potential and cost for SB 1122. In addition, UC ANR academics contributed to ongoing discussions hosted by CEC on the status of bioenergy development in California, in particular on the technical feasibility and environmental issues related to forest bioenergy in the State.
- Another project focused on thermochemical biomass conversion for fuels and power. Agricultural, forest, energy crop, and urban feedstocks were leached with a variety of solvents and analyzed for physical and chemical properties. Thermal properties associated with conversion through both oxidative and pyrolytic processes involved in gasification systems were investigated.
- A CE specialist project analyzed the potential linkage between bioenergy, fire risk reduction, and global trade in wood products. This included multistate work with the US Forest Service as well as private forest land owners and businesses that purchase supplies. The objective is to develop an integrated decision support system. The potential impact is to increase the opportunity for private forest land owners to participate in future markets for bioenergy.

- A CE advisor worked on a collaboration with the USDA Forest Service, which was supported by an over $400,000 grant, continuing work to evaluate California woody biomass as a bioenergy opportunity.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2013	Extension	Research
	1862	1862
Plan	267.6	398.6
Actual	248.4	387.4

II. Merit Review Process

The Merit Review Process that was Employed for this year included:

- Internal University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review

Brief Explanation

Scientific Peer Review

Each project funded under the Hatch Act is peer reviewed at the department level in the colleges/school at Berkeley, Davis, and Riverside. A peer review committee is appointed by the department chair. The committee evaluates the relevance, quality and scientific value of the proposed research. Upon completion of the peer review, the project is also reviewed at the dean's office for USDA compliance and forwarded to the Vice President's office for final review and submission to NIFA.

Merit Review

UC ANR's organizational structure emphasizes that resource allocation decisions will be driven by programmatic considerations and developed through a broad participatory process. This process includes review of the quality and relevance to program goals for all of the Division's programs.

At the statewide level, the UC ANR Program Council met almost monthly. It was chaired by the Associate Vice President, and included the four Executive Associate Deans, five strategic initiative leaders, and two county-based CE representatives, as well as other ex-officio administrative members. This group coordinates Divisionwide planning and delivery of programs and develops recommendations for allocation of Division resources. The Program Council reviewed all programmatic budget requests from a statewide perspective to make specific recommendations on budget expenditures and resource allocation principles. These recommendations were then considered by the Vice President for final allocation decisions.

UC ANR's strategic initiative leaders and advisory panels are key players in helping the Division meet its goals, by organizing division-wide conferences, developing five-year, statewide

strategic plans, and coordinating the internal competitive grants program. UC ANR's Program Teams provide an umbrella structure for the Division's many Workgroups to meet. These Program Teams carry out their essential leadership functions and enhance inter-workgroup communication and collaboration. During FY 2013, the five Strategic Initiatives held five respective conferences around the UC ANR Statewide Conference. In addition, during FY2013 seven Program Teams were able to meet, and 15 Workgroups met in conjunction. In this way, CE and AES personnel along with non-ANR partners were brought together to work on emerging and continuing issues. They looked at the Division's program priorities and determine efforts that will best address these needs.

During FY 2013, UC ANR's competitive grant program proposals were review by ad hoc, technical committees recruited by the strategic initiative leaders. The membership of these committees depended on the proposals received and included external experts. In FY 2014, after each proposal received at least two technical reviews by academics who had no conflict of interest with the proposal, the strategic initiative leaders rank the proposals and recommended a consensus slate of highly ranked proposals to Program Council. Each of the recommended proposals is discussed in detail by Program Council, and they make the final recommendations for funding. The Vice President makes the final decisions on allocations (awarded February 2014).

III. Stakeholder Input

Actions taken to seek stakeholder input that encouraged their participation included:

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from general public

Brief Explanation

UC ANR used a variety of mechanisms to seek stakeholder input on the development of Division program priorities and use of its research, extension and education funds. In addition, CE advisors delivering programs in 58 California counties received input on local needs from their local clientele on a daily basis. All of the input received from stakeholders was used by UC ANR members in program planning and implementation at the local, regional, and statewide level.

Research and Extension Center System Strategic Planning

UC ANR's Research and Extension Center system initiated a strategic planning process centered on stakeholder guidance. Each of the nine centers will develop a strategic plan to serve as a "living document," created in a flexible framework to set direction and focus effort

over the next 20 years. The strategic planning process is collaborative, future-oriented and utilization-focused. Stakeholder input is sought both through the diverse committees, including CE advisors, CE specialists, and AES faculty and members from external stakeholder groups, as well through broad feedback loops conducted throughout the process, reaching other key stakeholder groups identified by the committee. During 2013 two centers engaged in this new, rigorous strategic planning process that includes assessment, strategy formation, and implementation accountability. Situational and stakeholder analysis identifies key strengths and opportunities, as well as challenges to inform the development of the strategic directions, each with specific goals, intended outcomes, and key actions that include identified implementation responsibility and anticipated deliverables.

Strategic Initiative, Program Team, and Workgroup Meetings

The Strategic Initiative, Program Team, and Workgroup Meetings are the primary mechanism for accomplishing UC ANR's high priority research and extension goals through grassroots leadership. During FY 2013, the five Strategic Initiatives held five respective conferences around the UC ANR Statewide Conference. In addition, during FY2013 seven Program Teams were able to meet, and 15 Workgroups met in conjunction.
These meetings brought together AES and CE personnel and non-ANR partners to work on emerging and continuing priority issues in Division program areas. Workgroups involve external stakeholders in their program planning process and Workgroup activities and projects. The involvement of external stakeholders in the Workgroups ensures that real world needs are brought to the attention of the Division as programs are planned and implemented. External stakeholders on the workgroups include individual producers, representatives from local community groups, state and federal agencies, industry groups, consumer groups, and colleagues from other higher education institutions.

Statewide Program Reviews

Each of the Division's six statewide programs undergoes a routine program review with significant input from key stakeholder groups. The review committees include members from across the UC ANR network and external stakeholder representatives. During FY 2013 the Statewide Integrated Pest Management Program was reviewed by a committee that included AES faculty and CE specialists from the three UC ANR campuses, a CE advisor, and members from Utah State University, the Pistachio Research Board, and Clark Pest Control. As part of the review process, the committee solicited input from outside clientele, representatives of regulatory agencies, members of UC ANR's Pest Management Program Team and affiliated Workgroup members, CE Advisors and Specialists, and AES faculty through interviews and a web-based survey.

Formal Advisory Groups

The President's Advisory Commission on Agriculture and Natural Resources meets twice annually to advise and assist UC in identifying the educational needs of the state's agricultural, natural and human resources communities and ways to meet them through science-based research, educational outreach and classroom instruction. The members represent close to 30 different business, consumer, youth and government leaders from throughout California and meet twice a year to provide input. The UC ANR Vice President participates as a member of this Commission and brings the Commission's advice to the UC ANR Executive Council, which includes the four Deans from the UC ANR affiliated

colleges/school. This leadership council then provides strategic guidance in the articulation of long-term programmatic directions Divisionwide, the allocation of resources across units, and the development of UC ANR policies.

Each of the three colleges at Berkeley, Davis and Riverside and the School of Veterinary Medicine at Davis, have external stakeholder advisory councils that met at least annually to provide feedback on their research, extension, and teaching programs. In addition, departments may have advisory boards. The Statewide Programs also have advisory groups, some mostly composed of external members, which meet regularly to review progress and offer recommendations for future program direction.

Commodity Organizations/Marketing Order Boards

Members of these organizations provided their annual input on research and extension needs for their commodities to UC ANR members through regular meetings and discussion of funding for research projects. These individual groups also come together to form the California Commodity Committee that meets with the Vice President annually to offer specific recommendations on program planning and funding issues. In FY 2013 this group met to discuss the recent findings from UC nitrogen studies, and the current actions and potential solutions for reducing agriculture's nitrogen impact.

Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Methods for collecting Stakeholder Input

- Meeting with traditional stakeholder groups
- Survey of traditional stakeholder groups
- Meeting with traditional stakeholder individuals
- Survey of traditional stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

A statement of how the input was considered

- In the budget process
- To identify emerging issues
- Redirect extension programs
- Redirect research programs
- In the action plans
- To set priorities

Brief explanation of what you learned from your stakeholders

Stakeholder input is integral to the Division's many program planning and evaluation activities. To mention a few -- the Division's Strategic Vision document, the Strategic Initiatives' statewide strategic plans, the Research and Extension Centers' strategic plans, the Statewide Programs' 5-year reviews, the CE call for positions process, etc. all reflect significant stakeholder input to inform resource allocation decision making and guide these efforts into the future.

IV. Expenditure Summary

1. Total Actual Formula dollars allocated (prepopulated from C-REEMS)	
Extension	**Research**
Smith-Lever 3b & 3c	**Hatch**
7,030,434	6,186,159

2. Total Actual Dollars Planned Programs Inputs		
	Extension	**Research**
	Smith-Lever 3b & 3c	**Hatch**
Actual Formula	5,034,914	6,017,571
Actual Matching	4,034,914	6,017,571
Actual All Other	292,366,026	292,366,026
Total Actual Expended	302,435,854	304,401,168

3. Amount of above actual formula dollars expended which comes from carryover funds from previous years		
	Extension	**Research**
	Smith-Lever 3b & 3c	**Hatch**
Carryover	0	0

V. Planned Programs:

A. Healthy Families and Communities
B. Sustainable Food Systems
C. Sustainable Natural Ecosystems
D. Endemic and Invasive Pests and Diseases
E. Sustainable Energy
F. Water Quality, Quantity, and Security

A) Healthy Families and Communities

1) Healthy Families and Communities Planned Program Knowledge Areas

KA Code	Knowledge Area	%1862 Extension	%1862 Research
121	Management of Range Resources	0%	6%
305	Animal Physiological Processes	0%	23%
311	Animal Diseases	0%	6%
501	New and Improved Food Processing Technologies	0%	1%
604	Marketing and Distribution Practices	0%	2%
606	International Trade and Development	0%	2%
608	Community Resource Planning and Development	3%	1%
701	Nutrient Composition of Food	0%	3%
702	Requirements and Function of Nutrients and Other Food Components	1%	27%
703	Nutrition Education and Behavior	28%	7%
704	Nutrition and Hunger in the Population	1%	1%
723	Hazards to Human Health and Safety	0%	2%
724	Healthy Lifestyle	8%	1%
801	Individual and Family Resource Management	4%	1%
802	Human Development and Family Well-Being	7%	7%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	2%	5%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	0%	1%
805	Community Institutions, Health, and Social Services	2%	1%
806	Youth Development	37%	3%
903	Communication, Education, and Information Delivery	7%	0%
	Total	100%	100%

2) Healthy Families and Communities Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year: 2013	Extension	Research
Plan	31.9	52.3
Actual Paid Professional	34.8	48.8
Actual Volunteer	694.0	0.0

Actual dollars expended in this program (includes carryover funds from previous years)

Extension	Research
Smith-Lever 3b & 3c	**Hatch**
705,431	611,777
matching	**matching**
705,431	611,777
all other	**all other**
36,828,761	36,828,761

3) Healthy Families and Communities Planned Program Activity

Brief description of the Activity

UC ANR's integrated research and extension activities conducted research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Adults, children, youth and families in general
- Children in general
- Low and moderate income adults, children, youth and families
- Adults and children at-risk for nutrition-related health problems, including individuals living in poverty, recent immigrants, and African-American, Native American, and Hispanic populations
- Nutrition and healthcare professionals
- Preschool, primary and secondary school teachers and administrators
- Professional childcare providers
- Public agencies and private organizations concerned with food, nutrition and health

How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes. The Division looks forward to the re-invention into a system of greater value to California Extension.

4) Healthy Families and Communities NIFA Defined Standard Output Measures

FY 2013	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Actual	105,951	241,011	7	37	142	179

Patents Listed:

1. A METHOD FOR AUTOMATED, LARGE-SCALE MEASUREMENT OF THE SYNTHESIS AND BREAKDOWN RATES OF THE PROTEOME OR THE ORGANEOME.

2. Molecular Flux Rates Through Critical Pathways Measured by Stable Isotope Labeling In Vivo, as Targets and Biomarkers of Drug Action and Disease Activity
3. A SOD2 Antioxidant Derivative
4. IMPROVED INHIBITORS FOR THE SOLUBLE EPOXIDE HYDROLASE Case #2003-033-6
5. IMPROVED INHIBITORS FOR THE SOLUBLE EPOXIDE HYDROLASE Case #2003-033-7
6. PREVENTION OF DIABETIC NEPHROPATHY BY APPLICATION OF EPOXYEICOSANOIDS WITH SOLUBLE EPOXIDE HYDROLASE INHIBITORS
7. ANALGESIC EFFECTS OF sEH INHIBITORS IN NEUROPATHIC PAIN

5) Healthy Families and Communities State Defined Outputs

FY 2013	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Actual	45	82	140	10	9	95	1	4

6) Healthy Families and Communities State Defined Outcomes

a) Knowledge Outcomes

- 960 low-income individuals and families, participating in nutrition and consumer education programs, gained knowledge of food resource management techniques.
  Associated Knowledge Areas: 703 - Nutrition Education and Behavior, 801 - Individual and Family Resource Management

- 420 children and youth, participating in 4H club, community, in-school and afterschool educational programs, increased their level of science, agricultural and environmental literacy.
  Associated Knowledge Areas: 806 - Youth Development

- 92 youth educators and child resource specialists, participating in youth development education programs, gained knowledge of youth development practices.
  Associated Knowledge Areas: 806 -Youth Development

- 795 low-income children and youth, participating in EFNEP programs, gained knowledge of nutrition.
  Associated Knowledge Areas: 703 - Nutrition Education and Behavior
- 92 youth educators and child care resource specialists participating in youth development education programs, gained knowledge of youth development practices.
  Associated Knowledge Areas: 806 - Youth Development

- 248 individuals trained as trainers, participating in food safety education, gained knowledge of food safety practices.
  Associated Knowledge Areas: 703 - Nutrition Education and Behavior

- 1,458 adults, participating in food safety education, gained knowledge of food safety practices

  Associated Knowledge Areas: 703 - Nutrition Education and Behavior

- Youth, participating in the 4-H Children, Youth, and Families at Risk (CYFAR) project, increased science literacy.

  Issue (Who cares and Why)

  A significant proportion of California youth are at substantial risk for poor health, substance abuse and academic underachievement due to family, community, social, political and economic conditions. One approach to reducing their risk is by enhancing youth scientific literacy.

  What has been done

  The 4-H Children, Youth, and Families at Risk (CYFAR) project engages youth in science education to build the knowledge, skills, attitudes and positive behavior necessary for fulfilling lives. In Borrego Springs, high school teens engage 5th grade youth in afterschool gardening. In Winters, UC Davis undergraduate students act as mentors and facilitators of science education for K-8th grade youth. In Sacramento, 4-H teens work with elementary youth to hone their science skills through gardening and Youth Experiences in Science curricula.180 youth in grades K-6 participated once or twice per week. They were informally mentored by 22 teens who delivered curriculum activities. We recruited and trained the teens in inquiry-based science education, experiential education and specifically on gardening and the environment.

  Results

  Program evaluation showed that participating youth had positive attitudes towards science, an understanding and appreciation for the environment, and positive relationships in the program. The evaluations showed 79% enjoy nature and 61% believe they can make a difference in the world. The youth also gained skills by using scientific tools for gardening. Evaluation is ongoing to assess youth and teen outcomes resulting from program participation.

  In addition, their communities also benefit from partnerships with local organizations and individuals developed to continue the activities. In Sacramento, parents of youth participants plan to charter a 4-H community club to meet after school to continue 4-H activities after CYFAR funding ends. In San Diego, two family resource centers were established in partnership with local service organizations. In Yolo County, parents and other adults were recruited to lead youth activities such as soccer. In addition, movement has begun to re-form the County Youth Coalition, which could provide ongoing programs in underserved areas of the county.

  Associated Knowledge Areas: 806 - Youth Development

- A new innovative and practical research tool was developed to show where youth are thriving and where others need help.

  Issue (Who cares and Why)

  A key step in fostering healthy families and communities is presenting accurate, compelling and actionable community-scale data about the condition of youth. California wants and needs for its youth to thrive - not merely to survive or face fewer problems. But how do we know whether our young people are doing well?

  What has been done

To answer this question, the UC Davis Center for Regional Change and UC Cooperative Extension joined together to generate http://pyom.ucdavis.edu Putting Youth on the Map (PYOM), an interactive website that presents two georeferenced youth indices, plus 46 additional data layers that offer over 17,000 potential data combinations. The Youth Well-being Index (YWI) provides measures of teenagers' physical and emotional health, educational outcomes, social relationships and community contexts for areas bound by California school districts. The Youth Vulnerability Index (YVI) identifies places where young people might be especially vulnerable to a lack of support for their well-being (e.g. experience conditions associated with inadequate support: school drop-out/push-out, foster care referral, teen pregnancy, and very low household incomes). Over 130 youth, family or community development professionals participated in two introductory webinars. An introduction webinar is posted at PYOM under the tutorial tab.

Results

The data on these interactive maps allow users to identify areas where youth are becoming vulnerable to making unhealthy transitions to adulthood at relatively high rates, identify areas with relatively strong composite pictures of adolescent well-being, and provide baseline data for tracking change in the conditions of youth.

Users of PYOM can gather information to support grant proposal development; inform public and private investment; facilitate cross sector collaboration; and inform youth organizing, youth service, public policy and community advocacy at local, regional and statewide scales. In the first six weeks since the site's launch, more than 150 new users visited. Non-profit leaders used the site to access data for proposal writing, and youth advocates used the site as part of leadership training for young people.

Pending additional funding, the project team intends to develop a capacity-building strategy to help potential users apply the maps and data to enhance their efforts with and on behalf of youth. PYOM has demonstrated the power of ANR's campus-county continuum to create innovative and practical research tools.
Associated Knowledge Areas: 806 - Youth Development

b) Attitude Changes

- 1,160 food service staff, teachers, policy makers, local distributors, and community members, participating in community-based food systems education programs, increased awareness about local foods.
  Associated Knowledge Areas: 703 - Nutrition Education and Behavior, 608 - Community Resource Planning and Development

- 10,828 adults and families with children, participating in CalFresh and other obesity prevention programs, indicated increased readiness to adopt healthier dietary practices.
  Associated Knowledge Areas: 703 - Nutrition Education and Behavior

c) Skills Acquired

- 1,588 youth, participating in 4H clubs, acquired leadership and civic skills.
  Associated Knowledge Areas: 806 - Youth Development

- 1,452 youth, participating in 4H club, community, in-school and afterschool educational programs, acquired planning, problem solving, teamwork and other life skills.

  Associated Knowledge Areas: 806 - Youth Development

- Youth, participating in the new 4-H Pathways project, gained understanding and skills needed for higher education and career success.

  Issue (Who cares and Why)

  Research shows that high school graduates who select majors that are congruent with their interests, are able to match educational plans with requirements of desired careers, attend an institution that is a good match and develop realistic goals are more likely to be successful in achieving their educational and career aspirations. As such, young people need opportunities to explore and develop their educational and career interests as well as goal management skills.

  What has been done

  UC Cooperative Extension educators developed and implemented 4-H Pathways to Your Future: Destination UC, an education and career exploration project designed for youth in grades 7-12. The project included curriculum, guest speakers and experts from the community, as well as UC campus tours. Forty-nine youth from 4-H community clubs in Merced, Monterey and Shasta counties participated in the Pathways project.

  Results

  As a result of participating in the project, young people reported significant increases in their ability to connect academic and career aspirations to their interests, skills or talents; understanding of different pathways to higher education; identification of their pathway to higher education; understanding of how to prepare for UC; plans to attend UC; exploration of different careers; and the ability to set and manage goals. The Pathways project has the potential to serve as a UC educational outreach program for 4-H and other similar youth-serving programs. The findings are promising and indicate that the Pathways project addresses those areas of educational and career preparation that improve postsecondary success.

  Associated Knowledge Areas: 806 - Youth Development

d) Behavior Changes

- 10,482 low-moderate income individuals and families, participating in nutrition and consumer education programs, adopted recommended food resource management techniques.

  Associated Knowledge Areas: 703 - Nutrition Education and Behavior, 801 - Individual and Family Resource

- 9,046 low-income adults, participating in EFNEP or other nutrition education programs, improved one or more nutrition practices.

  Associated Knowledge Areas: 703 - Nutrition Education and Behavior

- 7,789 low-income adults, youth and families, participating in EFNEP and other nutrition education programs, improved in at least one food safety practice.

  Associated Knowledge Areas: 703 - Nutrition Education and Behavior

- Low-income, predominantly Latino, families, participating in the UC CalFresh program, adopted healthy lifestyle practices.

  Issue (Who cares and Why)

  Twenty percent of children are obese or overweight before their fifth birthday, which impacts their health, learning and self-esteem. Therefore, the early life influence of parents, caregivers and other family members in teaching and modeling good eating and physical activity habits should not be ignored. First 5 San Joaquin recognized the importance of parents and family in creating the foundation for healthy lifestyle habits and approached the UC CalFresh Nutrition Education Program in San Joaquin County. UC CalFresh is a key partner in providing families with in-home nutrition and exercise programs that focus on improving family eating and physical activity behaviors.

  What has been done

  UC CalFresh Family Nutrition Educators in San Joaquin County trained 15 First 5 Parent Health Educators to deliver the Happy, Healthy Me (HHM); Go, Glow, Grow (GGG); or Eating Smart, Being Active (ESBA) lessons. The lessons were presented to 1,255 parents with children aged birth to five in their homes. Eighty-three percent of the participants were Latino/Hispanic with the majority indicating their primary language was Spanish. The project design was based on the "parent as teacher" model. Educators worked with parents and their children in their homes to teach the lessons and activities from the UC CalFresh curricula. For families where the child was too young to participate and understand curricula activities, adult ESBA lessons were delivered to the parents. An evaluation was conducted by both the UC CalFresh Nutrition Education Program and Harder+Company Community Research for First 5 San Joaquin.

  Results

  Two hundred sixty parents completed the ESBA eight-lesson series. As evidenced by pre/post food behavior checklist results, parents who completed the series improved their food resource management practices, nutrition practices, food safety practices, frequency of reading labels, and ate a greater variety of vegetables and fruits following the lessons. Specifically, parents demonstrated improvement in their food resource management behaviors by increasing their frequency in planning meals that includes using a grocery list (61 percent), and comparing prices (54 percent). Nearly all parents (99 percent) "agreed" or "strongly agreed" that they felt more confident in their knowledge of how to live a healthy lifestyle and, importantly, how to help their child lead a healthy lifestyle. Since receiving services from a health educator, most parents (67 percent) indicated their child's physical activity level increased "a lot".

  Associated Knowledge Areas: 703 - Nutrition Education and Behavior

- Low-income families, participating in Nutrition Family and Consumer Science programs, adopted healthy lifestyle practices and experienced improved food security.

Issue (Who cares and Why)

Over 156,000 of Alameda County residents live at or below poverty level and are at risk for food insecurity
and chronic diseases associated with poor nutrition and lifestyle choices. UCCE's in-home nutrition education started in 1999 in three Oakland Housing Authority projects. Stairways were dark, the facilities unkempt, there was little apparent interest in learning about nutrition and healthy lifestyles. Many residents did not know their neighbors and did not open the door to outreach staff with nutrition information. Local human services agencies had conducted research and demonstration projects, but rarely were there long enough to gain the confidence and respect of the community and see change. UCCE's assessments found that those in greatest need failed to participate in group classes. These families needed more personalized education to gain nutrition and survival skills.

What has been done

UCCE in Alameda County offers ongoing in-home nutrition education targeting three low-income housing units and surrounding underserved areas. It promotes nutrition and life skills, nurturing healthy attitudes and practices that can be passed to future generations. Educators stress prevention of obesity - a risk factor associated with high blood pressure, diabetes, heart and kidney disease and more. The goal is to increase the residents' life skills, fruit and vegetable intake, food safety, active lifestyles, and supplemental food program participation. UCCE was a member of the Oakland Housing Authority's Project Hope revitalization advisory committee and was the first to help a low-income housing project start gardens combining flowers with edible plants. A recycling company provided green clippings and a farmer provided straw for the soil; health department funds paid for rototilling; nurseries as far away as Sonoma donated plants, seeds, fruit trees and shrubbery. Two specialists from UC Berkeley taught 40 parents and children to plant and care for at least 26 plots. The in-home education triggered the interest of local agencies and led to a 15-member HUD-funded collaborative serving families displaced by demolition of the complex with the gardens.

Results

UCCE submitted grant applications and received over $1 million funding from the Haas Junior Fund foundation, Highland Hospital, Alameda County Health Department, California Nutrition Network, and over $400,000 in-kind support from the Alameda County Social Services Agency. With this fund support continuous nutrition education was offered over a 14-year period to families in three Oakland housing projects. UCCE's outreach promoting a better quality of life changed how many view the value of healthy lifestyles. More than 4,500 residents graduated with six hours of education. More than 2,000 Food Behavior Checklist Evaluations conducted one year later show positive changes in the following areas: money management - 79 percent; nutrition - 89 percent; food safety - 37 percent. Forty-eight percent of participants increased fruit and 41 percent increased vegetable variety, 52 percent reduced fat and 51 percent reduced salt, 15 percent reduced soda, and 33 percent increased activity. In addition,

non-traditional sites in the area, such as liquor stores and gas stations, now offer fresh fruits.

Associated Knowledge Areas: 801 - Individual and Family Resource Management, 703 - Nutrition Education and Behavior, 704 - Nutrition and Hunger in the Population, 724 - Healthy Lifestyle

- Low-income, multi-ethnic seniors, participating in the collaborative "Staying Healthy" program, adopted healthy lifestyle practices.

Issue (Who cares and Why)

The number of seniors over 65 in California is increasing at a rate greater than overall population. Baby Boomers began to come of age in 2011, accelerating the rate at which California's population is turning gray. Chronic diseases are systemic -- 80 percent of seniors in the U.S. have at least one and 50 percent have two (CDC). Among Californians over 65, 54 percent suffer from hypertension, 24 percent heart disease, 17 percent with cancer, 15 percent diabetes and 10 percent asthma (CDA). A UC ANR study found that 40 percent of low-income elders from 22 senior sites (n=377) were living with multiple chronic conditions - many with more than four. Educational programs to promote healthy nutrition/lifestyles could contribute to a better quality of life of California's vulnerable elders.

What has been done

The rise in chronic nutrition- and lifestyle- related conditions associated with longer lives present challenges and opportunities for UCCE educators. UC ANR acknowledged the significance of emerging senior concerns in a 2010 special issue of California Agriculture journal, "The Golden State Goes Gray: What Aging Will Mean for California." As part of its long-term Quality of Life Initiative, UCCE Alameda County partnered with the Alameda County Social Services Agency to conduct a "Staying Healthy" program for multi-ethnic elders living in low-income senior housing. Interactive nutrition education was conducted at six sites in north, west and south county. Farmers markets provided fresh produce at each class site. Baseline and exit food behavior data evaluated showed positive change in healthy food choices, food safety and physical activity. Focus groups assessed positive behavior changes seniors had made to stay healthy.

Results

Of the 267 senior participants, 247 graduated with 6 to 7 hours of education. More than 200 seniors wrote their personal Staying Healthy stories to share with other elders. Pre/post food behavior evaluations found positive changes over baseline for seniors: being more active 98 percent, drinking more water 97 percent, handling food safer 80 percent; and increasing vegetable and fruit intake 70 percent. Exit focus groups found seniors wanted more nutrition/wellness education and mini farmers markets on site. Social Services funding for the project was $87,777. The president of Alameda County Board of Supervisor's, a long-time supporter of programs for elders, was the graduation speaker at one site. Housing agencies managing low-income senior housing in three counties have requested similar nutrition and wellness education programs

Associated Knowledge Areas: 703 - Nutrition Education and Behavior, 724 - Healthy Lifestyle

- Low-income families, participating in UC CalFresh, adopted food resource management practices to stretch their food budgets, reducing their food insecurity.

Issue (Who cares and Why)

During the past four years an estimated 3.8 million California adults could not afford to put sufficient food on the table. California is one of the states hit hardest by the economic downturn. Unemployment rates more than doubled and the poverty rate rose faster than the national level (2007- 2009). Participation in CalFresh (formerly Food Stamps) increased 6.8 percent from 2011 to 2012, significantly higher than the national increase of 2.9 percent. Add to this rising food costs and the results translate to significant increases in food insecurity, which is defined as not having

What has been done

Educating low-income families in food selection and resource management skills can decrease the risk of food insecurity. UC CalFresh Nutrition Education Program has made this a priority. The curriculum, called "Plan, Shop, Save and Cook," provides participants the concrete food resource management skills needed to improve their food security status while making more healthful choices. The first workshop educates adults on the benefits of preparing a balanced meal plan. During the second workshop, participants explore a variety of nutrition facts labels and learn how to make the best choices while shopping. The third workshop teaches how to determine the least expensive food, while purchasing items with a shopping list. Unit pricing, bulk purchases, generic brands, convenience items, alternative protein sources and preventing spoilage and waste are covered. During the final workshop participants prepare and taste low-cost nutritious foods. They practice all of the skills they have learned by creating a one-week meal plan.

Results

This approach to food resource management has been beneficial to many Californians. Pre-post surveys of 1,373 participants statewide documented increased use of smart-shopping behaviors: 46 percent improved in meal planning; 43 percent, in using a shopping list; and 36 percent, in comparing prices. Health behaviors also improved as a result of the classes: 40 percent thought more frequently about healthy food choices; 54 percent used a food label more often; and 38 percent prepared more varied meals. Most notable however is that 33 percent of participants reported they run out of food by the end of the month less often.

Associated Knowledge Areas: 704 – Nutrition and Hunger in the Population

- Youth, participating in the 4-H20 Water Wizards program, adopted water conservation practices.

Issue (Who cares and Why)

Many children today particularly those from urban, economically disadvantaged communities do not have opportunities to experience and understand nature. These children are the stewards of our future and the ecological health of the planet. They need the chance to discover the workings and wonder of nature, and to develop science and reasoning skills necessary to critical thinking and problem solving. Opportunities for youth to explore and enjoy natural places are an investment in our children and our Earth

What has been done

UC ANR provides environmental education and outdoor experiences to youth living in economically disadvantaged neighborhoods. As part of the National 4-H20 effort, a UCCE advisor and specialist worked together to develop the 4-H20 Water Quality Awareness in Urban Environments curriculum, which is being implemented in San Mateo, Los Angeles, and Sacramento counties. Through the 12-week 4-H20 Water Wizards project, 4th-6th grade children in after school programs explore water and the environment to help youth learn about water quality, water conservation and watershed issues, and create and implement a plan to impact a water issue in their community

Results

Several hundred 4th, 5th, and 6th grade students participating in the Sacramento County program reported using less water since participating in 4-H Water Wizards. This is particularly important this year given California is experience a drought

Associated Knowledge Areas: 806 – Youth Development

e) Social/Health Condition Changes

- Youth, participating in 4-H and their communities, benefitted from stronger relationships and networks.

Issue (Who cares and Why)

The benefits of 4-H participation are well documented for youth, however little is known about the impact of 4-H participation on community social capital. Social capital can be defined as the connections among individuals and the social networks and the norms of reciprocity and trustworthiness that arise from them. 4-H programs foster youth-adult partnerships that encourage active participation by youth and adults, often over many years. There is interest in studying how these unique partnerships contribute to the well-being of youth and of the greater community in which the 4-H development program is based.

What has been done

A multistate, integrated collaboration used surveys and follow-up interviews with randomly selected youth participants. Research was conducted to: 1) determine 4-H experiences that contribute to the development of youth's social capital; 2) identify and analyze how the level of the 4-H program's community involvement impacts the level of social capital among youth and adult volunteers; 3) identify and analyze how the 4-H program's community involvement impacts the development of social capital within the community; 4) identify and analyze how the public visibility of the role 4-H youth play in communities affect the opportunities afforded them by adults to participate in other community activities; 5) identify and analyze how diversity among adult volunteers and 4-H youth impacts the level of social capital within the community; and 6) identify and analyze how the level of the 4-H program's community involvement impacts the level of the various capital within the community.

Results

California 4-H club youth living in suburban, urban and rural counties have gained more social capital. Youth who participate in 4 or more community service projects per year have a higher level of social capital than youth who participate less. The results of this work demonstrate the importance of 4 H to the overall health of the community. Community development specialists and others interested in facilitating successful community change efforts can use the results of this research in their work as well. Finally, the results of this study will offer a unique opportunity for cross-program and cross-state collaboration on strategies that grow healthy families and young people and that build prosperous sustainable communities.

Associated Knowledge Areas: 803 - Sociological and Technological Change Affecting Individuals, Families and Communities, 806 - Youth Development

7) Healthy Families and Communities Planned Program External Factors

External factors which affected outcomes

- Natural disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government regulations
- Competing public priorities
- Populations changes (immigration, new cultural groupings, etc.)

8) Healthy Families and Communities Planned Program Evaluation Studies

Evaluation Results

UC ANR's most notable qualitative impacts that were realized, as well as the quantitative outcomes recorded from the evaluation studies, are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's federal Planned Program summary of accomplishments highlights UC ANR's most significant work during FY 2013, especially the research developments. In addition, the State Defined Outcomes section captures UC ANR's clientele behavior change outcomes, which demonstrate important program successes resulting from the research and extension network

B) Sustainable Food Systems

1) Sustainable Food Systems Planned Program Knowledge Areas

KA Code	Knowledge Area	%1862 Extension	%1862 Research
102	Soil, Plant, Water, Nutrient Relationships	16%	4%
111	Conservation and Efficient Use of Water	3%	3%
201	Plant Genome, Genetics, and Genetic Mechanisms	2%	15%
202	Plant Genetic Resources	3%	4%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	4%	8%
204	Plant Product Quality and Utility (Preharvest)	7%	5%
205	Plant Management Systems	28%	4%
206	Basic Plant Biology	1%	16%
211	Insects, Mites, and Other Arthropods Affecting Plants	2%	4%
212	Pathogens and Nematodes Affecting Plants	1%	5%
302	Nutrient Utilization in Animals	4%	4%
307	Animal Management Systems	9%	1%
501	New and Improved Food Processing Technologies	1%	3%
502	New and Improved Food Products	2%	5%
503	Quality Maintenance in Storing and Marketing Food Products	2%	2%
601	Economics of Agricultural Production and Farm Management	8%	3%
603	Market Economics	1%	3%
702	Requirements and Function of Nutrients and Other Food Components	0%	6%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	4%	3%
723	Hazards to Human Health and Safety	2%	2%
	Total	100%	100%

2) Sustainable Food Systems Planned Program Inputs

Actual amount of professional FTE/Sys expended this program

Year: 2013	Extension	Research
Plan	96.2	131.2
Actual Paid Professional	98.9	142.8
Actual Volunteer	0.0	0.0

Actual dollars expended in this program
(includes carryover funds from previous years)

Extension	Research
Smith-Lever 3b & 3c 2,005,411	**Hatch** 2,460,427
matching 2,005,411	**matching** 2,460,427
all other 107,769,408	**all other** 107,769,408

3) Sustainable Food Systems Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Food producers (e.g. farmers/ranchers and rangeland owners/operators/managers, including conventional organic, small and large producers)
- Agricultural advising professionals (e.g. Pest Control Advisors, crop advisors, landscape professionals)
- Allied industry companies including seed and supply companies
- Food processors, handlers, retailers, and suppliers
- Public regulatory agencies and private non-profit advocacy groups
- Food consumers, members of the general public

How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to many Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes.

4) Sustainable Food Systems NIFA Defined Standard Output Measures

FY 2013	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Actual	324,690	1,694	5	89	457	546

Patents listed:

1. BIFIDOBACTERIAL GENE SEQUENCES REQUIRED FOR CATABOLISM OF MILK OLIGOSACCHARIDES
2. THE REDUCTION OF HYDROGEN SULFIDE (H2S) FORMATION IN WINE YEAST STRAINS VIA ALLELE REPLACEMENT, EXCHANGING NATIVE ALLELES IN THE TARGET STRAIN
3. SELECT GALACTO-OLIGOSACCHARIDES ARE PREFERENTIALLY CONSUMED

BY DIFFERENT SPECIES OF BIFIDOBACTERIA ENABLING TARGETED ENRICHMENT
4. A HYBRID BUSH BABY LIMA BEAN VARIETY (BBL302) RESISTANT TO THE TARNISHED PLANT BUG LYGUS HESPERUS
5. 'KinnowLS' MANDARIN

5) Sustainable Food Systems State Defined Outputs

FY 2013	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Actual	298	101	139	29	27	316	0	25

6) Sustainable Food Systems State Defined Outcomes

a) Knowledge Changes

- 340 farm, ranch, landscaping owners/managers and allied industry professionals, participating in the programs, gained knowledge of aspects of comprehensive management systems for plant and animal production.
  Associated Knowledge Areas: 102 - Soil, Plant, Water, Nutrient Relationships, 204 - Plant Product Quality and Utility (Preharvest), 205 - Plant Management Systems, 206 - Basic Plant Biology, 302 - Nutrient Utilization in Animals, 307 - Animal Management Systems, 601 - Economics of Agricultural Production and Farm Management

- 240 farm and ranch owners/managers, participating in the programs, gained knowledge of business management practices and marketing strategies, including the costs and risks associated with producing specialty crops
  Associated Knowledge Areas: 601 - Economics of Agricultural Production and Farm Management

- 80 farm, ranch and landscaping owners/managers and allied industry professionals, participating in the programs, gained knowledge of pest and disease management for plant and animal production.
  Associated Knowledge Areas: 211 - Insects, Mites, and Other Arthropods Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants

- 1250 farm owner/operators and allied industry professionals, participating in agriculture education programs, gained of crop and varietal selection factors for plant production.
  Associated Knowledge Areas: 201 - Plant Genome, Genetics, and Genetic Mechanisms

- New knowledge on conservation tillage systems for California tomatoes indicates cost savings and resource conservation benefits.

  Issue (Who cares and Why)

  Rising fuel and labor costs oblige growers to carefully cut production costs. Reducing intercrop tillage typically associated with bed preparation operations is a promising means to cut costs in tomato production systems. A variety of "conservation tillage" (CT) crop production systems have been developed in other regions for crops such as corn, wheat, soybean, and cotton. To what extent, though, might CT principles and practices be adapted to tomato production in California?

  What has been done

  Since 1999, UC researchers have been evaluating CT practices for tomato production in California. This work compares standard till (ST) and CT systems in terms of economics, profitability, soil properties, and dust emissions through a tomato-cotton rotation. The CT system reduced the total number of passes over the field by an average of nine per year, eliminating disking, chiseling, landplaning, and listing and shaping beds. CT system yields were comparable to those achieved by the ST approach, increasing profitability with CT because costs decreased and revenue remained unchanged.

  Results

  Although conservation tillage reduced the number of tillage passes by 50 percent. The total cultural cost of tomato production was reduced by about 10 percent: 41 percent for harvest, 14 percent for seed, only 20 percent for preplant tillage operations. The value of the savings from reducing labor and fuel prices will increase as labor rates and fuel costs per gallon increase. For example, CT reduced fuel use by 16 gallons per acre. At a price of $1 per gallon, the savings is $16; at a price of $3 per gallon, the savings is $39. Reducing the number of ground preparation operations by adopting CT always will reduce resource use and cut costs; however, overall profit may not improve if CT leads to a decrease in income due to a crop yield reduction that is greater than cost savings. Even if yields are lower under CT,
  profit can increase if the reduction in costs is greater than the income loss due to yield reduction. Other environmental or ecosystem services result from reducing tillage. Dust generation in the CT systems was reduced by more than 60 percent and greenhouse gas emissions were lower, particularly when coupled with the use of cover crops. Elements of these systems are now being adapted and pursued by some processing and fresh-market tomato growers on the west side of the San Joaquin Valley.

  Associated Knowledge Areas: 102 - Soil, Plant, Water, Nutrient Relationships, 205 - Plant Management Systems, 601 - Economics of Agricultural Production and Farm Management

- New knowledge on conservation tillage systems for California cotton indicates cost savings and resource conservation benefits.

  Issue (Who cares and Why)

  Cotton production in California's San Joaquin Valley relies on soil tillage for seedbed preparation, weed control, and postharvest pest management. Intensive

tillage practices throughout the production season contribute to the crop's yield and help producers manage risk. But these practices are costly, requiring considerable labor, specialized tillage implements, and adequate tractor horsepower. Despite incentives programs through the Farm Bill and USDA encouraging tillage reduction, along with rising costs of tillage, most cotton in the San Joaquin Valley continues to be produced using traditional, heavy tillage practices. Cotton is one of the most tillage-intensive agronomic crops produced in California; tillage systems for cotton have changed little over the past 50 years.

What has been done

UC ANR researchers have evaluated a number of reduced-input Conservation Tillage systems (CT) in the San Joaquin Valley. These studies address "learning curve" issues for cotton producers such as the need for well-timed seeding techniques, adequate soil moisture for crop establishment and postharvest crop management practices that comply with state-mandated pink bollworm regulations. Once successful seeding techniques are worked out and adequate crop stands are established, yields of CT cotton are comparable to cotton produced through conventional tillage practices.

Results

Recent UC ANR studies show that CT cotton systems can reduce fuel use by more than 70 percent, increase soil carbon by more than 20 percent, and reduce dust emissions by more than 60 percent, relative to conventional till approaches. The cost savings and resource conservation benefits provided by CT production systems in cotton warrant further evaluation. Provided yield and profitability are maintained, various conservation tillage systems are becoming attractive to producers and more common in the San Joaquin Valley cotton-growing areas.

Associated Knowledge Areas: 102 - Soil, Plant, Water, Nutrient Relationships, 205 - Plant Management Systems, 601 - Economics of Agricultural Production and Farm Management

- New knowledge about cover cropping shows a number of potential benefits for Central Valley annual-cropping systems.

Issue (Who cares and Why)

Diversifying crop rotations may be a means for reducing disease pressures and improving long-term productivity in California's annual crop production valleys. Using "off-season" or intercrop cover crops might be a useful crop diversification strategy that also could add organic matter to the soil and improve soil function and quality. In general, farmers have little experience with cover-cropping practices and have been reluctant to use them.

What has been done

UC ANR scientists evaluated the impacts of adding winter cover crops to annual crop rotations in California's San Joaquin and Sacramento Valley production regions. In a study initiated in 1999 at the UC West Side Research and Extension Center, the use of triticale/rye/vetch cover crops increased soil carbon by an average of 4,000 pounds per acre after four years under standard tillage and by 4,456 pounds per acre in a conservation or reduced tillage system. When projecting these results into the future to take into account the storage and emissions of various greenhouse

gases such as CO2, CH4, and N2O, the cover-crop systems -- particularly when coupled with reduced tillage -- can reduce emissions significantly relative to today's standard systems in which cover cropping and conservation tillage are not used. In addition, the use of subsurface drip systems may enhance the effects of cover crops and conservation tillage in reducing greenhouse gases.

Results

This initial research shows a number of potential benefits to using cover crops in Central Valley annual-cropping systems, including the improvement of soil properties and the mitigation of greenhouse gas emissions. Researchers and farm advisors are busy developing more grower-friendly practices and systems. They are studying the use of subsurface drip or overhead low-pressure irrigation systems in cover-crop systems, the evaluations of various new cover crops and mixes, the timing of cover-crop establishment and termination, how to efficiently manage irrigation water resources in cover-crop systems, and more efficient means for cover-crop incorporation or management systems.

Associated Knowledge Areas: 102 - Soil, Plant, Water, Nutrient Relationships, 205 - Plant Management Systems

b) Attitude Changes

- 2003 farm and ranch owners/managers and allied industry professionals, participating in the programs, are more likely to try out or adopt recommended cultural practices, pest and disease management, or other aspects of comprehensive management systems for animal and plant production.

  Associated Knowledge Areas: 102 - Soil, Plant, Water, Nutrient Relationships, 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants, 204 - Plant Product Quality and Utility (Preharvest), 205 - Plant Management Systems, 211 - Insects, Mites, and Other Arthropods Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants, 307 - Animal Management Systems

c) Skill Changes

None to report

d) Behavior Changes

- 200 small farm and ranch owner/operators and managers, participating in agriculture education programs, utilized alternative marketing of their crops to local consumers, including farmers markets, schools, restaurants, community supported agriculture boxes.

  Associated Knowledge Areas: 601 - Economics of Agricultural Production and Farm Management

- Innovative mechanical trunk shaker is implemented commercially for California table olives, and offers hope for long-term industry sustainability.

Issue (Who cares and Why)

The economic sustainability and consequent longevity of California's historic black ripe table olive industry is challenged by the cost of hand-harvest, which is often 50 to 75 percent of gross return. Hand-harvest costs are volatile due to

dynamics in annual and regional crop load and labor supply, and are influenced by competition between growers and producers of other commodities. Reliance on hand-harvest in concert with weather-related crop failures has led to Tulare County olive acreage shrinking by 20 percent over the past decade. Multi-generational families of olive growers either left agriculture or diversified to other crops, forcing processors to import olives, often of a lower quality, to maintain inventory. Development of a mechanical harvesting method offers hope for long-term industry sustainability.

What has been done

The California Olive Committee funded efforts between UC ANR researchers and University of Cordoba, Spain researchers and industry stakeholders to develop mechanical harvesters. A UCCE specialist estimates that 80 percent fruit removal is necessary for economic feasibility of mechanical harvest. In 2006, another UCCE specialist formed a team of engineers, horticulturists and farm advisors to develop and test mechanical harvesters. A trunk shaker originally used for pistachio and a prototype canopy-contact harvester developed for jatropha were modified for use on olive. Trunk shaker technology may be more applicable to olive trees with a smooth trunk, upright growth habit, and short scaffolds, whereas canopy-contact harvesters may be better suited for hedgerow plantings managed with mechanical pruning.

Results

The research team found that the mechanical harvesters achieved near 80 percent fruit removal efficiency, and panels of sensory and consumer analysts are unable to detect a difference between mechanically harvested and hand-harvested olives. This UC research that showed trunk shaking technology is feasible for table olive harvest inspired fabricators to continue improving upon the technology. In the 2012 season, the trunk shaking technology was first implemented commercially for table olives in Sacramento Valley.

Associated Knowledge Areas: 205 - Plant Management Systems

- California rice farmers cultivate new varieties to increase yields and milling quality.

Issue (Who cares and Why)

Over 90% of the rice acreage in California is planted to public varieties. Producers and processors need reliable data on varietal performance under commercial production practices in order to make management decisions on the selection of appropriate varieties for different locations and planting times.

What has been done

The UCCE statewide uniform variety-testing program is an ongoing research project initiated over 30 years ago. It is conducted throughout the California rice producing regions. The breeding staff at the California Rice Experiment Station in Biggs, CA, develops these varieties, then the UCCE trials evaluate the adaptability of public varieties and advanced lines to different climatic zones and soil types. UCCE extends this information on rice variety adaptation and cultural practices to rice growers.

Results

California rice farmers cultivate the newly released, UCCE evaluated, public rice varieties. Over 70% of the approximately 550,000 acres of rice in California are planted to these varieties (M-104, M-205, M-206, M-208, and M-105) released over the last 10 years.

Associated Knowledge Areas: 201 - Plant Genome, Genetics, and Genetic Mechanisms

- Orchard owner/operators and managers adopt superior varieties of nut crops to improve profitability.

Issue (Who cares and Why)

Fruit and nut tree crop agriculture is a large and highly valued component of the California economy. However, farm profitability is under pressure from steadily rising production costs, depressed value of some commodities, and increased competition from imports. Tree crop producers and the allied industry constantly need new information to adapt to changing conditions and to remain competitive.

What has been done

UCCE trials in California's Central Valley evaluate selections for possible new cultivar release. Information was extended through a Statewide Pistachio Day, Almond Institute, field days, short courses, and educational presentations. This UCCE research and extension focusses on improving the culture and management of these nut crops, addressing both the ecological sustainability and economic viability of the production system.

Results

Orchard owner/operators and managers gained knowledge of pistachio and almond cultivars suitable for planting in commercial orchards. As of early 2013, orchard owner/operators and managers planted approximately 10,000 acres of the new UC pistachio cultivars, which harvest earlier than the major existing cultivar allowing for more efficient allocation of trained personal, harvesting equipment and hulling facilities. In addition, orchard owner/operators and managers are planting the newly released Winters variety, which is an early pollinator, more productive, and the nuts have higher value than previously available choices.

Associated Knowledge Areas: 601 - Economics of Agricultural Production and Farm Management

e) Social/Health Condition Changes

None to report

f) Environmental Changes

None to report

g) Economic Changes

- Producers increase sales as consumers become more aware of local, specialty crops.

Issue (Who cares and Why)

Although Placer and Nevada Counties have a vibrant local food movement, less than two percent of the population buys local specialty crops regularly. A wide range of specialty crops is grown locally, and increasing sales would lead to more economically viable specialty crop sectors in local agriculture. In addition, increasing consumption of fresh fruits and vegetables is critical to combating the growing health crisis of obesity, diabetes and other diseases.

What has been done

UCCE Placer/Nevada led a collaborative effort that includes internal and external stakeholders. The program Consumer Outreach to Enhance Awareness and Marketing of Specialty Crops in the Sierra Foothill conducted an outreach campaign to reach 50,000 consumers, through the "Eat Local" website, Facebook pages, and point-of-sale materials. 27 promotional tastings of local produce were offered at farmers' markets, health centers, senior centers, and food pantries. In addition, a community dinner was held to help connect consumers and local farmers, and to encourage consumers to buy local produce; 81 consumers and 19 farmers attended.

Results

The farmers market and other event tastings, community dinners and promotional activities helped 150 local producers increase sales. In addition, consumers were educated about seasonal availability, nutritional value, preparation, and purchase points for local specialty crops to encourage consumers to try and buy local produce.

Associated Knowledge Areas: 601 - Economics of Agricultural Production and Farm Management

- Small farmers on the Central Coast of California are successfully growing new or promising profitable specialty crops.

Issue (Who cares and Why)

The south Central Coast of California with its diverse climatic niches and soil types provides opportunity for the year-round production of a variety of unique crops. These crops and the proximity to diverse markets attract and support a large group of small acreage specialty crop entrepreneurs. Agriculture is extremely competitive for small farms in California. This agricultural community needs assistance and consultation in the production and marketing of alternative new crops, in order to offer valuable support to small scale and limited resource farmers in Santa Barbara and San Luis Obispo counties.

What has been done

UCCE continues to conduct research, outreach, and education on alternative new crops, expanding efforts with specific crops that have demonstrated high potential such as blueberries. UCCE evaluates new or promising specialty crops as alternatives for small farms on the Central Coast. In 2013 presentations in English and Spanish were extended. A Spanish speaking webinar series on small farm management in collaboration with eXtension was held.

Results

Alternative new specialty crops are successfully being grown along the Central Coast of California. There is new and growing small farm acreage of crops such as

blueberries, raspberries, blackberries, sweet onions, and vegetable soybean. There is a dramatic increase in new acreage of blackberries in Ventura, Santa Barbara, and San Luis Obispo. In addition, there is an increase in harvested acreage of coffee in Santa Barbara County, intercropping with avocados in established avocado orchards. These growers are successfully growing and selling coffee as an alternative new crop.

Associated Knowledge Areas: 601 - Economics of Agricultural Production and Farm Management

- Beginning farmers, participating in farm management education, grow their businesses.

Issue (Who cares and Why)

Beginning farmers often struggle to gain access to equipment, land, credit and markets. They often need to learn sound business practices and accumulate years of experience to move forward. The UCCE Farmer Individual Development Account program is helping beginning farmers develop a learning network, write business plans, and have successful experiences so they can grow their farm businesses.

What has been done

Humboldt County UCCE coordinated the Farmers Individual Development Account program with several other local agencies. This business development model has been used before with homebuyers and other small businesses; this program was the first in the county for farmers. The non-profit California FarmLink spearheaded the movement to use this program with farmers. A UCCE advisor worked with other agencies to open the way for farmers to participate, by developing workshops specifically for farm business planning and by fostering a learning community with new and experienced farmers. Participants put $100 per month in savings accounts and attended workshops for 18 months (with a break for the growing season). At the end of the program their savings were matched 2:1 for a capital improvement for their farm.

Results

As a result of this project, all eight farmers developed a strong network among themselves and with a farmer-mentor in a non-competitive mode. The participants wrote business plans and attended financial planning workshops, met personnel from many agencies available to help them, and created a savings plan towards a major purchase. Three farmers met the savings program and were awarded a matching grant (funds are from private foundations supporting the program). One built a mist system for starting plants, another bought a rototiller, and the third bought materials for planting beds and a cold frame. The new farmers now benefit from a strong support network and are growing a variety of crops and selling both on the internet and at farmers markets.

Associated Knowledge Areas: 601 - Economics of Agricultural Production and Farm Management

7) Sustainable Food System

External factors which affected outcomes

- Natural disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public policy changes
- Government regulations
- Competing public priorities
- Populations Changes (immigration, new cultural groupings, etc.)

8) Sustainable Food Systems Planned Program Evaluation Studies

Evaluation Results

UC ANR's notable, qualitative impact statements, as well as the quantitative outcomes recorded from the evaluation studies, are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's federal Planned Program summary of accomplishments highlights UC ANR's most significant work during FY 2013, especially the research developments. In addition, the State Defined Outcomes section captures UC ANR's clientele behavior change outcomes, which demonstrate important program successes resulting from the research and extension network.

C) Sustainable Natural Ecosystems

1) Sustainable Natural Ecosystems Planned Program Knowledge Areas

KA Code	Knowledge Area	%1862 Extension	%1862 Research
101	Appraisal of Soil Resources	2%	5%
102	Soil, Plant, Water, Nutrient Relationships	4%	15%
111	Conservation and Efficient Use of Water	5%	4%
112	Watershed Protection and Management	3%	3%
121	Management of Range Resources	17%	4%
122	Management and Control of Forest and Range Fires	6%	1%
123	Management and Sustainability of Forest Resources	20%	2%
131	Alternative Uses of Land	6%	3%
132	Weather and Climate	1%	7%
133	Pollution Prevention and Mitigation	3%	7%
135	Aquatic and Terrestrial Wildlife	10%	5%
136	Conservation of Biological Diversity	9%	11%
141	Air Resource Protection and Management	6%	4%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	1%	3%
212	Pathogens and Nematodes Affecting Plants	0%	4%
305	Animal Physiological Processes	0%	4%
311	Animal Diseases	0%	3%
605	Natural Resource and Environmental Economics	4%	7%
610	Domestic Policy Analysis	1%	6%
723	Hazards to Human Health and Safety	2%	2%
	Total	100%	100%

2) Sustainable Natural Ecosystems Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year: 2013	Extension	Research
Plan	29.4	73.5
Actual Paid Professional	27.4	70.8
Actual Volunteer	0.0	0.0

Actual dollars expended in this program (includes carryover funds from previous years)

Extension	Research
Smith-Lever 3b & 3c 577,522	**Hatch** 1,240,714
matching 577,522	**matching** 1,240,714
all other 60,450,487	**all other** 60,450,487

3) Sustainable Natural Ecosystems Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension activities conducted research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs use PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Farmers
- Ranchers
- Inland fishery owners/operators
- Governmental agencies
- Agricultural and fishing organizations
- Owners/managers of private and public rangeland, forest and wildlands
- Community organizations
- Resource managers

How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities fo Practice, to answer "Ask an Expert" questions, and for other networking purposes. The Division looks forward to the re-invention into a system of greater value to California Extension

4) Sustainable Natural Ecosystems NIFA Defined Standard Output Measures

FY 2013	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Actual	36,698	0	0	32	333	365

5) Sustainable Natural Ecosystems State Defined Outputs

FY 2013	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Actual	33	22	4	5	5	148	9	1

6) Sustainable Natural Ecosystems State Defined Outcomes

a) Knowledge Changes

- 192 farm, ranch, private and public forest and wildlands owners/mangers, participating in natural resource management programs, gained knowledge of strategies and techniques for sustainable use of natural resources.
  Associated Knowledge Areas: 123 - Management and Sustainability of Forest Resources, 135 Aquatic and Terrestrial Wildlife, 136 Conservation of Biological Diversity

- 200 farm owners/operators, participating in soil quality education programs, gained knowledge of soil conditions and management practices to improve soil health.
  Associated Knowledge Areas: 101 - Appraisal of Soil Resources, 102 - Soil, Plant, Water, Nutrient Relationships

- 113 ranch and private and public rangeland owners/managers, participating in rangeland management programs, gained knowledge of recommended techniques for rangeland monitoring and management, and grazing and browsing.
  Associated Knowledge Areas: 121 - Management of Range Resources

b) Attitude Changes

None to report

c) Skill Changes

None to report

d) Behavior Changes

- Forest landowners take action on forest land succession planning.

Issue (Who cares and Why)

California has 16 million acres of commercial forest land, and another 10 million acres of oak woodlands. Much of this land is owned by private landowners (50% of forest land, 80% of woodlands). There is the need to develop management plans for private lands that take a systematic approach to sustainable strategies in order to realize the economic, environmental and cultural goals of the landowners. Given forestland management decisions are implemented over a long time span, often exceeding an individual's lifetime, estate planning is critical to ensure the long-term duration of forest management goals.

What has been done

A collaboration of UCCE specialists and advisors worked together to develop an online e-learning module for forest landowners in 3 pilot counties. The e-learning site had 1,200 visits since launched, with an average length of 14 minutes per visit. Six sessions of a "Brown Bag Webinar Series on Forest Science" were conducted. Also, a series of workshops on estate planning for forest owners were presented, to address the financial, legal, and emotional dimensions.

Results

50 forest landowners initiated estate planning and successional planning with heirs. Whether the property is to stay in the family, be given protection in a conservation easement, or another agreed-to outcome, family communication is critical. Good estate planning can save heirs thousands of dollars and may prevent the selling of parcels or heavy logging to pay estate taxes. This is particularly true in California, where land values are high and many forest landowners are land rich and cash poor.

Associated Knowledge Areas: 605 - Natural Resource and Environmental Economics

- Los Angeles County adopts an Oak Conservation Plan for improved oak woodland conservation and management.

Issue (Who cares and Why)

California has 10 million acres of oak woodlands or hardwood rangelands. In addition to oak woodland conservation in wildlands, it is also important to manage oaks in the urban landscape. Los Angeles County has 28 species and subspecies of oaks, and approximately 10 million residents. Goldspotted oak borer (GSOB) Agrilus auroguttatus, an invasive pest, is a growing threat to oaks. GSOB has contributed to on-going oak tree mortality occurring on federal, state, private, and local Native American lands in Southern California. Widespread oak mortality can have severe implications to the environment and human safety.

What has been done

UCCE educated County Supervisors and their staff about the oak resource, its value, sensitivities and resilience, and the current risks and conservation problems. A CE Specialist coauthored the Oak Conservation Plan for Los Angeles County, including a report on valuing oaks in land development. The information was presented to the Board of Supervisors. They held 4 public meetings on the Plan. A lot of outreach and education was done to develop consensus between building industry and environmentalists. The value of oaks in land development is to be published in 2013-2014.

Results

The collaborative group of ecologists and resource managers overcame long-term resistance by both land developers and conservation groups, to successfully work with the county to manage this resource. The adoption of the conservation plan required both groups to change their attitudes and behavior about oaks during land development.

Associated Knowledge Areas: 605 - Natural Resource and Environmental Economics

e) Social/Health Condition Changes

None to report

f) Environmental Condition Changes

None to report

g) Economic Changes

None to report

7) Sustainable Natural Ecosystems Planned Program External Factors

External factors which affected outcomes

- Natural disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public policy changes
- Government regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

8) Sustainable Natural Ecosystems Planned Program Evaluation Studies

Evaluation Results

UC ANR's quantitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's federal Planned Program summary of accomplishments highlights UC ANR's most significant work during FY 2013, especially the research developments.

D) Endemic and Invasive Pests and Diseases

1) Endemic and Invasive Pests and Diseases Planned Program Knowledge Areas

KA Code	Knowledge Area	%1862 Extension	%1862 Research
102	Soil, Plant, Water, Nutrient Relationships	1%	0%
111	Conservation and Efficient Use of Water	0%	1%
133	Pollution Prevention and Mitigation	0%	2%
135	Aquatic and Terrestrial Wildlife	2%	4%
136	Conservation of Biological Diversity	1%	2%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	2%
206	Basic Plant Biology	1%	2%
211	Insects, Mites, and Other Arthropods Affecting Plants	13%	13%
212	Pathogens and Nematodes Affecting Plants	20%	38%
213	Weeds Affecting Plants	15%	3%
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	0%	1%
215	Biological Control of Pests Affecting Plants	4%	9%
216	Integrated Pest Management Systems	39%	8%
305	Animal Physiological Processes	0%	3%
311	Animal Diseases	1%	3%
312	External Parasites and Pests of Animals	1%	1%
402	Engineering Systems and Equipment	0%	1%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%	1%
721	Insects and Other Pests Affecting Humans	2%	3%
722	Zoonotic Diseases and Parasites Affecting Humans	0%	3%
	Total	100%	100%

2) Endemic and Invasive Pests and Diseases Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year: 2013	Extension	Research
Plan	67.9	103.2
Actual Paid Professional	63.7	94.7
Actual Volunteer	0.0	0.0

Actual dollars expended in this program (includes carryover funds from previous years)

Extension	Research
Smith-Lever 3b & 3c 12,906,555	**Hatch** 1,413,782
matching 12,906,555	**matching** 1,413,782
all other 71,468,928	**all other** 71,468,928

3) Endemic and Invasive Pests and Diseases Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension activities conducted research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Farmers
- Ranchers
- Rangeland owners/managers
- Landscaping professionals
- Owners/operators of allied agricultural industries
- General public
- Crop and pest consultants

How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities fo Practice, to answer "Ask an Expert" questions, and for other networking purposes. The Division looks forward to the re-invention into a system of greater value to California Extension

4) Endemic and Invasive Pests and Diseases NIFA Defined Standard Output Measures

FY 2013	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Actual	106,832	0	1	213	425	638

Patents Listed:

1. NEMATODE RESISTANT GRAPE ROOTSTOCK 9407-14

5) Endemic and Invasive Pests and Diseases State Defined Outputs

FY 2013	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Actual	72	49	30	9	9	238	19	16

6) Endemic and Invasive Pests and Diseases State Defined Outcomes

a) Knowledge Changes

- 723 farm, ranch, rangeland, landscaping, and boat owner/operators and managers, allied industry professionals, and members of the public participating in the programs, gained knowledge of prevention, detection, and treatment strategies and techniques for management of invasive species.

  Associated Knowledge Areas: 135 - Aquatic and Terrestrial Wildlife, 211 - Insects, Mites, and Other Arthropods, Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants, 213 - Weeds Affecting Plants, 216 - Integrated Pest Management Systems, 312 - External Parasites and Pests of Animals

- 1225 farm and landscaping owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, gained knowledge of pest management techniques, including Integrated Pest Management strategies.

  Associated Knowledge Areas: 211 - Insects, Mites, and Other Arthropods Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants, 213 - Weeds Affecting Plants 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants, 216 - Integrated Pest Management Systems

b) Attitude Changes

- 655 farm, ranch, rangeland, and boat owner/operators, pest control advisers, and other allied industry professionals, participating in the pest and disease management programs, are more willing to adopt recommended strategies and techniques to control endemic and invasive pests and diseases.

  Associated Knowledge Areas: 211 - Insects, Mites, and Other Arthropods Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants, 213 - Weeds Affecting Plants 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants, 215 - Biological Control of Pests Affecting Plants, 216 - Integrated Pest Management Systems, 311 - Animal Diseases, 312 - External Parasites and Pests of Animals

c) Skills Changes

- 215 farm owners/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, gained skills to detect, monitor, and treat pests.

  Associated Knowledge Areas: 211 - Insects, Mites, and Other Arthropods Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants, 213 - Weeds Affecting Plants, 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants, 216 - Integrated Pest Management Systems

- School staff, participating in the School Turf IPM program, gained knowledge and skills to reduce pesticide use and runoff to improve community and environmental health.

Issue (Who cares and Why)

Since the enactment of the Healthy Schools Act (HSA) in 2001, both UC Cooperative Extension (UCCE) and the California Department of Pesticide Regulation (DPR) have worked with school districts to provide information about integrated pest management (IPM). IPM strategies include modifying horticultural practices, such as changing mowing heights and managing irrigation appropriately. These practices can reduce the amount of pesticides used on school grounds to help schools meet HSA standards and provide a safe and healthy environment for students, teachers and staff. DPR has coordinated numerous workshops for school districts covering general landscape and building IPM topics; however, attendees requested more detailed training about turf IPM since they manage turf playgrounds and sports fields. UCCE has extensive experience in this area, and thus was called upon to help schools implement this policy.

What has been done

Working closely with DPR, UCCE advisors from multiple counties and specialists conducted hands-on training for school landscape staff throughout California. At each workshop, school staff was provided UC ANR resources to assist them in implementing IPM at their schools. Trainers helped the participants interpret the results of their soil tests, discussed identification and management of weeds and other pests, and conducted irrigation evaluations. Most of the training involved hands-on involvement by the participants at school fields such as measuring irrigation output, soil sampling, and weed identification and management.

Results

Seventy-five public school staff members across the state were trained. Post-training evaluation revealed that there was a strong improvement in knowledge related to IPM in turf. Most significantly, the trainees recognized that many turf problems could be ameliorated through appropriate turf culture such as managing irrigation, mowing and fertilization rather than the use of pesticides. Additionally, by demonstrating how to evaluate and improve irrigation systems, the trainees also learned about the impact of appropriately managing water to avoid runoff and improve water quality. The program was such a success that DPR is continuing their partnership with UCCE and expanding the School Turf IPM training to additional areas in the state.

Associated Knowledge Areas: 216 - Integrated Pest Management Systems

d) Behavior Changes

- 67 farm, ranch, rangeland, and landscaping owner/operators and managers, and allied industry professionals, participating in the programs, adopted treatment practices for invasive species

  Associated Knowledge Areas: 135 - Aquatic and Terrestrial Wildlife, 211 - Insects, Mites, and Other Arthropods, Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants, 213 - Weeds Affecting Plants, 216 - Integrated Pest Management Systems, 312 - External Parasites and Pests of Animals

- 189 farm owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs,

adopted recommended pest management practices, including integrated pest management strategies.

Associated Knowledge Areas: 211 - Insects, Mites, and Other Arthropods Affecting Plants, 212 - Pathogens and Nematodes Affecting Plants, 213 - Weeds Affecting Plants 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants, 216 - Integrated Pest Management Systems

- Retail nurseries and garden centers, participating in UC IPM education programs, extend IPM to customers.

Issue (Who cares and Why)

IPM is an eco-system-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, and modification of cultural practices. Pesticides are used only after monitoring indicates they are needed, and pest control materials are selected and applied. To extend these pest management practices that minimize risks to humans, non-target organisms, and the environment, UC IPM conducted outreach and education to retail stores. Garden center and nursery employees are often the first people consumers ask for pest control information.

What has been done

Over the past two years, UC IPM has trained about 150 employees representing 60 retail stores and 22 Northern California counties in regional train-the-trainer workshops. In 2012-2013, 22 stores in 9 counties also displayed a UC IPM interactive touch-screen kiosk to help customers solve their pest problems. In addition, IPM Advocates are another major initiative to improve IPM in retail stores. These IPM consultants to retail stories, certified through collaboration with Bay Area Storm water Management Agencies, expanded their reach to now serve 80 Northern California retail garden centers and nurseries.

Results

Recent surveys confirm that retailers are passing IPM information along to consumers who UC ANR probably wouldn't reach. 2013 follow-up surveys show that 91% of those who responded have used materials from the training to educate other store employees or customers. Surveys, prepared by the California Department of Pesticide Regulation which funded the program, indicate that over 76% of participating stores used the UC IPM website for identifying pests and solving problems, over 70% increased shelf space for green or less-toxic pest management products, and over 76% increased sales of green products in 2012.

Associated Knowledge Areas: 216 - Integrated Pest Management Systems

e) Social/Health Condition Changes

None to report

f) Environmental Changes

None to report

g) Economic Changes

None to report

7) Endemic and Invasive Pests and Diseases Planned Program External Factors

External factors which affected outcomes

- Natural disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public policy changes
- Government regulations
- Competing Public priorities
- Population changes (immigration, new cultural groupings, etc.)

8) Endemic and Invasive Pests and Diseases Planned program Evaluation Studies

Evaluation Results

UC ANR's notable, qualitative impact statements, as well as the quantitative outcomes recorded from the evaluation studies, are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's federal Planned Program summary of accomplishments highlights UC ANR's most significant work during FY 2013, especially the research developments. In addition, the State Defined Outcomes section captures UC ANR's clientele behavior change outcomes, which demonstrate important program successes resulting from the research and extension network.

E) Sustainable Energy

1) Sustainable Energy Planned Program Knowledge Areas

KA Code	Knowledge Area	%1862 Extension	%1862 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	1%
111	Conservation and Efficient Use of Water	0%	1%
123	Management and Sustainability of Forest Resources	23%	0%
133	Pollution Prevention and Mitigation	0%	2%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	9%
202	Plant Genetic Resources	0%	16%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	14%
204	Plant Product Quality and Utility (Preharvest)	0%	4%
205	Plant Management Systems	0%	3%
206	Basic Plant Biology	0%	15%
212	Pathogens and Nematodes Affecting Plants	0%	2%
402	Engineering Systems and Equipment	22%	3%
403	Waste Disposal, Recycling, and Reuse	0%	1%
503	Quality Maintenance in Storing and Marketing Food Products	0%	1%
511	New and Improved Non-Food Products and Processes	0%	17%
605	Natural Resource and Environmental Economics	22%	6%
608	Community Resource Planning and Development	33%	0%
609	Economic Theory and Methods	0%	1%
610	Domestic Policy Analysis	0%	2%
611	Foreign Policy and Programs	0%	2%
	Total	100%	100%

2) Sustainable Energy Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year: 2013	Extension	Research
Plan	0.4	7.0
Actual Paid Professional	0.5	9.3
Actual Volunteer	0.0	0.0

Actual dollars expended in this program (includes carryover funds from previous years)

Extension	Research
Smith-Lever 3b & 3c 9,122	**Hatch** 171,144
1862 matching 9,122	**1862 matching** 171,144
1862 all other 7,018,596	**1862 all other** 7,018,596

3) Sustainable Energy Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Relevant agency and private-sector partners
- Lawmakers working on issues related to energy
- Members of the public in general
- Agricultural producers of crops for use as biofuels

How was eXtension used?

None to report

4) Sustainable Energy Defined Standard Output Measures

FY 2013	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Actual	0	0	1	1	15	16

Patents Listed:

1. Identification of New Genes and Proteins Associated With Plant Cell Wall Deconstruction in the Filamentous Fungus, Neurospora Crassa

5) Sustainable Energy State Defined Outputs

FY 2013	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Actual	0	0	0	0	0	12	0	0

6) Sustainable Energy State Defined Outcomes

a) Knowledge Changes
None to report

b) Attitude Changes
None to report

c) Skill Changes
None to report

d) Behavior Changes
None to report

e) Social/Health Condition Changes
None to report

f) Environmental Condition Changes
None to report

g) Economic Condition Changes
None to report

7) Sustainable Energy Planned Program External Factors

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public Priorities
- Populations changes (immigration, new cultural groupings, etc.)

8) Sustainable Energy Planned Program Evaluation Studies

Evaluation Results

UC ANR's quantitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's federal Planned Program summary of accomplishments highlights UC ANR's most significant work during FY 2013, especially the research developments.

F) Water Quality, Quantity and Security

1) Water Quality, Quantity and Security Planned Program Knowledge Areas

KA Code	Knowledge Area	%1862 Extension	%1862 Research
102	Soil, Plant, Water, Nutrient Relationships	5%	16%
103	Management of Saline and Sodic Soils and Salinity	6%	1%
111	Conservation and Efficient Use of Water	32%	14%
112	Watershed Protection and Management	25%	13%
121	Management of Range Resources	1%	0%
123	Management and Sustainability of Forest Resources	0%	2%
124	Urban Forestry	1%	0%
131	Alternative Uses of Land	0%	2%
132	Weather and Climate	2%	4%
133	Pollution Prevention and Mitigation	20%	5%
135	Aquatic and Terrestrial Wildlife	0%	4%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	21%
205	Plant Management Systems	1%	4%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	3%	0%
403	Waste Disposal, Recycling, and Reuse	2%	2%
404	Instrumentation and Control Systems	0%	1%
405	Drainage and Irrigation Systems and Facilities	2%	1%
501	New and Improved Food Processing Technologies	0%	6%
605	Natural Resource and Environmental Economics	0%	1%
723	Hazards to Human Health and Safety	0%	3%
	Total	100%	100%

2) Water Quality, Quantity and Security Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year: 2013	Extension	Research
Plan	23.3	13.0
Actual	22.0	11.7

Actual dollars expended in this program (includes carryover funds from previous years)

Extension	Research
Smith-Lever 3b & 3c 446,773	**Hatch** 119,727
matching 446,773	**matching** 119,727
all other 8,829,846	**all other** 8,829,846

3) Water Quality, Quantity and Security Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension activities conducted research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs use PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Governmental agencies
- Water managers
- UC campus-based water centers
- The general public
- Farmers
- Ranchers
- Agricultural organizations
- Owners/managers of private and public rangeland, forest and wildlands

How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities fo Practice, to answer "Ask an Expert" questions, and for other networking purposes. The Division looks forward to the re-invention into a system of greater value to California Extension.

4) Water Quality, Quantity and Security NIFA Defined Standard Output Measures

FY 2013	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Actual	0	0	1	7	55	62

Patents listed:

1. IN SITU SOIL NITRATE SENSOR

5) Water Quality, Quantity and Security State Defined Outputs

FY 2013	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Actual	3	13	4	1	2	29	0	2

6) Water Quality, Quantity and Security State Defined Outcomes

a) Knowledge Changes

- 407 landscape owner/operators and managers, allied nursery industry professionals, public agency representatives, and members of the public, participating in water quality education programs, gained knowledge of recommended management practices for preserving water quality.
  Associated Knowledge Areas: 112 - Watershed Protection and Management

- 72 landscape owner/operators and managers, and members of the public, participating in water conservation education programs, and gained knowledge of water use and conservation practices.
  Associated Knowledge Areas: 111 - Conservation and Efficient Use of Water

b) Attitude Changes

None to report

c) Skill Changes

- 47 landscape owner/operators and managers and allied industry professionals, participating in water management education programs, gained water conservation skills.
  Associated Knowledge Areas: 111 - Conservation and Efficient Use of Water

- 106 farm owner/operators and managers, and allied industry professionals, participating in agriculture education programs, gained knowledge of irrigation and water management practices.
  Associated Knowledge Areas: 111 - Conservation and Efficient Use of Water

d) Behavior Changes

None to report

e) Social/Health Condition Changes

None to report

f) Environmental Condition Changes

None to report

g) Economic Condition Changes

None to report

7) Water Quality, Quantity and Security Planned Program External Factors

External factors which affected outcomes

- Natural disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public policy changes
- Government regulations
- Competing public priorities
- Populations changes (immigration, new cultural groupings, etc.)

8) Water Quality, Quantity and Security Planned Program Evaluation Studies

Evaluation Results

UC ANR's quantitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's federal Planned Program summary of accomplishments highlights UC ANR's most significant work during FY 2013, especially the research developments.